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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: The Project involves the parking improvements for Orange County Facilities Management to include additional parking, re-surfacing for existing parking areas and site improvements for better water drainage associated with the parking areas
 - 1. Project Location: Orange County, Florida.
 - 2. Owner: Board of Orange County Commissioners, Orange County, Florida
- B. Work of this Contract consists of, but is not limited to
 - 1. Construction administrative and procedural requirements as necessary to produce a complete and properly functioning facility.
 - 2. Sitework, foundation and slab work, including earthwork excavation and compaction for utilities.
 - 3. Concrete curbs and walks.
 - 4. Parking lot lighting improvements.

1.03 CONTRACTS

- A. Project will be constructed under a General Construction Agreement.

1.04 USE OF PREMISES

- A. Contractor shall have full use of existing site premises for construction operations during construction period. Contractor's use of premises is limited only by the County's right to perform work or to retain other contractors on portions of Project, when established at designated times.

1.05 OWNER-FURNISHED PRODUCTS

- A. The County may choose to furnish certain portions of work, materials, equipment and systems. When such is to be furnished, the County will provide descriptions of work to Contractor, who will in turn notify related parties.

1. The County will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Unless noted otherwise, the County will arrange and pay for delivery of the County-furnished items according to Construction Schedule.
3. After delivery, the County will inspect delivered items for damage. Contractor shall be present for and assist in the County's inspection.
4. If the County-furnished items are damaged, defective, or missing, the County will arrange for replacement.
5. The County will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. The County will furnish Contractor the earliest possible delivery date for the County-furnished products. Using the County-furnished earliest possible delivery dates, Contractor shall designate delivery dates of the County-furnished items in Construction Schedule.
7. Architect / Engineer shall review Shop Drawings, Product Data, and Samples and return them to appropriate parties noting discrepancies or anticipated problems in use of product.

1.06 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: These Specifications are organized into Divisions and Sections using the 16-division format and the CSI "MasterFormat" numbering system.
 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the Table of Contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
- B. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.03 MINOR CHANGES IN THE WORK

- A. The County Representative 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."

1.04 PROPOSAL REQUESTS

- A. The County-Initiated Proposal Requests: The County 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. Proposal Requests issued by the County Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days 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 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.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
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 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.
 5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.05 CHANGE ORDER PROCEDURES

- A. On the County's approval of a Proposal Request, the County Project Manager will issue a Change Order for signatures of the County and Contractor on AIA Document G701.

1.06 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

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.03 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.

1.04 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate 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. Submittals Schedule.
 - 2. Submit the Schedule of Values to the County 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 the 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. County Representative's name and address.
 - d. Architect's project number.
 - e. Contractor's name and address.
 - f. Date of submittal.

2. 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.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. 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. Include evidence of insurance or bonded warehousing if required.
6. 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.
7. 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.
8. 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.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and County Representative and paid for by the County.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between the County and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: The date for each progress payment is the 15th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.
- D. Payment Application Forms: Use forms provided by the County for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect / County Representative will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire the County's insurance.

16. Initial settlement survey and damage report if required.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for the County occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when the County took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. Administrative and supervisory personnel.
 - 5. Project meetings.
- B. Contractor shall have each subcontractor participate in coordination requirements

1.03 COORDINATION

- A. Coordination: Coordinate construction operations included in various 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.

- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings in areas of limited space availability for maximum utilization of space for efficient installation of different components and where coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Indicate relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

- B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff 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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys 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.

1.05 PROJECT MEETINGS

- A. 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: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, Construction Manager, if one is retained by Owner, and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Construction Manager, if one is retained by Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability.
 - m. Office, work, and storage areas.
 - n. Equipment deliveries and priorities.
 - o. First aid.
 - p. Security.
 - q. Progress cleaning.
 - r. Working hours.
- 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 and Construction Manager, if one is retained by Owner, of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Submittals.
 - g. Review of mockups.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Required performance results.
 - u. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements.
 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, Construction Manager, if one is retained by Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
- 3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
 - 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01320
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Submittals Schedule.
 - 4. Daily construction and field condition.
 - 5. Special reports.
 - 6. Construction photographs.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- C. Event: The starting or ending point of an activity.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either the County or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

- E. Major Area: A story of construction, a separate building, or a similar significant construction element.
- F. Milestone: A key or critical point in time for reference or measurement.

1.04 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and the County, and other information specified.
- B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's and Construction Manager's final release or approval.
 - 7. Scheduled dates for purchasing.
 - 8. Scheduled dates for first installation.
- C. Preliminary Construction Schedule: Unless directed otherwise, submit two printed copies; one a single sheet of reproducible media, and one a print.
- D. Contractor's Construction Schedule: Unless directed otherwise, submit/email electronic and two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
- E. Construction Photographs: Unless directed otherwise, submit two prints of each photographic view within seven days of taking photographs.
 - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade stock, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
 - 2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3. Media: Submit a complete set of photographic media in protective envelopes, with each submittal of prints as a Project Record Document. Identify date photographs were taken.
 - a. Provide digital images on CD-R Discs.
 - F. Daily Construction Reports: Submit three copies at weekly intervals.
 - I. Special Reports: Submit three copies at time of unusual event.
 - H. Field Condition Reports: Submit three copies at time of discovery of differing conditions.
- 1.05 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, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from parties involved.
 2. Coordinate each construction activity in the project with other activities and schedule them in proper sequence.
 - C. Auxiliary Services: Provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule. Issue updates as they occur, when agreed by all parties.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established the Notice to Proceed to date of Final Completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work.
 1. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 3. Startup and Testing Time: Include necessary number of days for startup and testing.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and the County's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: When phasing is required, arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by the County: Include a separate activity for each portion of the Work performed by the County.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. County-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Uninterruptible services.
 - b. Partial occupancy before Substantial Completion.

- c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
- a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, interim milestones, and Final Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.
- G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.03 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within 15 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction

activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.05 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. High and low temperatures and general weather conditions.
 5. Accidents.
 6. Meetings and significant decisions.
 7. Unusual events (refer to special reports).
 8. Stoppages, delays, shortages, and losses.
 9. Meter readings and similar recordings.
 10. Emergency procedures.
 11. Orders and requests of authorities having jurisdiction.
 12. Change Orders received and implemented.
 13. Construction Change Directives received.
 14. Services connected and disconnected.
 15. Equipment or system tests and startups.
 16. Partial Completions and occupancies.
 17. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare 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.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals (as a minimum), update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, the County, 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.

3.02 CONSTRUCTION PHOTOGRAPHS

- A. Photographic Media: Provide either of the following.
 - 1. Digital: Minimum image resolution of 1600 by 1200 pixels. Minimum camera resolution of 3.1 megapixels.
- B. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- C. Periodic Construction Photographs: Unless directed otherwise, take not less than four color photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken.
 - 1. Field Office Prints: Retain one set of prints of periodic photographs in field office at Project site, available at all times for reference. Identify photographs the same as for those submitted to Architect and Construction Manager.
 - 2. Digital Media File Type: tif or jpeg.
- D. Final Completion Construction Photographs: Unless directed otherwise, take not less than eight color photographs after date of Substantial Completion for submission as Project Record Documents. Architect and Construction Manager will direct photographer for desired vantage points.
 - 1. Digital Media File Type: tif or jpeg.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires responsive action.
- B. Informational Submittals: Written information that does not require approval. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

- A. 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. 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.
- B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, the County, or other parties is required, allow 14 days for initial review of each submittal.
 3. If intermediate submittal is necessary, process it in same manner as initial submittal.
 4. Allow 7 days for processing each resubmittal. Allow 14 days for processing each concurrent resubmittal review.
 5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect..
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect and OC Capital Projects Manager.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Unique identifier, including revision number.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Other necessary identification.
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to OC PM and concurrent reviewer in addition to specified number of copies to Architect.
 2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
 3. Transmittal Form: Unless directed otherwise, use AIA Document G810 .
- H. 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.
- I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit four copies (or email if color selection is not required) of each submittal, unless otherwise indicated. Architect will email or return three copies. Mark up and retain one returned copy as a Project Record Document.
- 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 printed 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 written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.

- i. Mill reports.
 - j. Standard product operating and maintenance manuals.
 - k. Compliance with recognized trade association standards.
 - l. Compliance with recognized testing agency standards.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 - 4. Number of Copies: Submit one (1) original (reproducible, when possible) and six (6) copies of each submittal unless directed otherwise. Architect will retain two (2) copies, return two (2) copies to Owner, and return two (2) copies and original (or reproducible) to Contractor.
 - a. Mark up and retain one returned print as a Project Record Drawing.
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
- 1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 - 2. Samples for Initial Selection: When required by individual Specification Sections, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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.
4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
 - a. Generic description of Sample.
 - b. Product name or name of manufacturer.
 - c. Sample source.
5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
 - a. Size limitations.
 - b. Compliance with recognized standards.
 - c. Availability.
 - d. Delivery time.
6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
 - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
7. Number of Samples for Initial Selection: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submitted set with options selected.
8. Number of Samples for Verification: Submit four sets of Samples. Architect will retain two Sample sets; the remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
 - a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

9. 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 not incorporated into the Work, or otherwise designated as the County's property, are the property of Contractor.

- F. Product Schedule or List: 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.
 2. Number and name of room or space.
 3. Location within room or space.

- G. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for action.

- H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

- I. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

- J. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

- K. 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. Use appropriate AIA form unless directed otherwise. 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.

2.02 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. Architect will not return copies.
 2. Certificates and Certifications: Provide a notarized 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.

- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names

and addresses, names and addresses of architects and owners, and other information specified.

- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- I. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.
- L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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.
- M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.

2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Operation and Maintenance Data."
- O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service 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.
- R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- S. Construction Photographs: Comply with requirements in Division 1 Section "Construction Progress Documentation."

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Review and Acceptance Stamp: Stamp each submittal with a uniform, review and acceptance 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.

3.02 ARCHITECT'S ACTION

- A. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. Reviewed
 - 2. Revise and resubmit.
 - 3. Furnish as corrected.
 - 4. Rejected.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This 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-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 quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. In most situations, mockups will establish the standard by which the Work will be judged.

- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.04 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.05 REGULATORY REQUIREMENTS

- A. Copies of Regulations: Be aware of, and when requested, obtain copies of specific regulations applicable to particular portions of work involved. Retain at Project site to be available for reference by parties who have a reasonable need.

1.06 SUBMITTALS

- A. Qualification Data: 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.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- D. Reports: Prepare and submit certified written reports that 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. Ambient 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.

E. 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.

1.07 QUALITY ASSURANCE

A. 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.

B. 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.

C. 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.

D. 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.

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 to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.08 QUALITY CONTROL

- A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
 1. Contractor's responsibility is to engage a qualified testing agency to perform these quality-control services.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Special Tests and Inspections: **Contractor** will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction
 1. Testing agency will notify Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and reinspect corrected work.
- C. 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.
- 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 revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.
- 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. 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 Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- 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

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. 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," "approved," "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. "Installer": 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. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

- J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- K. "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.

1.03 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. Conflicting Requirements: 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 uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. 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.
- D. Copies of Standards: Each entity engaged in construction on Project must 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 and make them available on request.
- E. Abbreviations and Acronyms for 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 in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of November, 2001.

<p>ADAAG Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov</p>	<p>(800) 872-2253 (202) 272-5434</p>
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CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	(888) 293-6498 (202) 512-1530
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	(601) 634-2355
DOD	Department of Defense Specifications and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MILSPEC	Military Specification and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434

1.04 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 Gale Research'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-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800

AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen) www.anla.org	(202) 789-2900
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(941) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800

ASCA	Architectural Spray Coaters Association www.ascassoc.com	(609) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010

BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CCFSS	Center for Cold-Formed Steel Structures www.umn.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CGSB	Canadian General Standards Board www.pwgsc.gc.ca/cgsb	(819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000

CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eifsfacts.com	(800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsintitute.org	(216) 241-7333
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FSC	Forest Stewardship Council www.fscoax.org	52 951 5146905
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com/gana	(785) 271-0208
GRI	Geosynthetic Research Institute www.drexel.edu/gri	(215) 895-2343

GTA	Glass Tempering Division of Glass Association of North America (See GANA)	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (See CSA)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISSFA	International Solid Surface Fabricators Association	(702) 567-8150

I3A	International Imaging Industry Association (Formerly: PIMA - Photographic & Imaging Manufacturers Association) www.pima.net	(914) 698-7603
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
IWS	Insect Screening Weavers Association (Now defunct)	
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
LSGA	Laminated Safety Glass Association (See GANA)	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(614) 228-6194
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)	
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613

NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NAMI	National Accreditation and Management Institute, Inc.	(304) 258-5100
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(414) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-6372

NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSA	National Stone Association (See NSSGA)	
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association (Formerly: NSA - National Stone Association) www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo and Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (703) 779-1022
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
PGI	PVC Geomembrane Institute //pgi-tp.ce.uiuc.edu	(217) 333-3929
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400

RFCI	Resilient Floor Covering Institute www.rfci.com	Contact by mail only
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabfurn.com	(516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.screenmfgassociation.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/SPFD	Society of the Plastics Industry (The) Spray Polyurethane Foam Division (See SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 444-0242

SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 705-9898
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USITT	United States Institute for Theatre Technology, Inc. www.culturenet.ca/usitt	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (See WCSC)	

WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WIC	Woodwork Institute of California www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: 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-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
FBC	Florida Building Code www.floridabuilding.org	(850) 487-1824
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533
SBCCI	Southern Building Code Congress International, Inc. www.sbcci.org	(205) 591-1853

D. Federal Government Agencies: 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-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(202) 708-5082
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley Laboratory (See LBNL)	
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-5605
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
RUS	Rural Utilities Service (See USDA)	(202) 720-9540

TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

E. State Government Agencies: 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-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CAPUC (See CPUC)

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Products Laboratory //txforests-service.tamu.edu	(936) 639-8180

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Sewers and drainage.
 - 2. Water service and distribution.
 - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 4. Heating, cooling and humidity control facilities.
 - 5. Ventilation.
 - 6. Electric power service.
 - 7. Lighting.
 - 8. Telephone service.
- C. Support facilities include, but are not limited to, the following:
 - 1. Temporary roads and paving.
 - 2. Dewatering facilities and drains.
 - 3. Project identification and temporary signs.
 - 4. Waste disposal facilities.
 - 5. Field offices.
 - 6. Storage and fabrication sheds.
 - 7. Lifts and hoists.
 - 8. Temporary elevator usage.
 - 9. Temporary stairs.
 - 10. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Environmental protection.
 - 2. Stormwater control.
 - 3. Tree and plant protection.
 - 4. Pest control.
 - 5. Site enclosure fence.
 - 6. Security enclosure and lockup.

7. Barricades, warning signs, and lights.
8. Covered walkways.
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

1.03 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.

1.04 USE CHARGES

- A. Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 1. Owner's construction forces.
 2. Occupants of Project.
 3. Architect.
 4. Testing agencies.
 5. Personnel of authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.
- C. Water Service: When available on site, use water from Owner's existing water system without metering and without payment of use charges. When not existing or available on site, pay for temporary water service use charges obtained through temporary installations, whether metered or otherwise, for water used during construction activities.
- D. Electric Power Service: When available on site, use electric power from Owner's existing system without metering and without payment of use charges. When not existing or available on site, pay for temporary electric power service use charges obtained through temporary installations, whether metered or otherwise, for electricity used during construction activities.

1.05 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
 2. 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.

1.06 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
1. 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.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
 2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts.

2.02 EQUIPMENT

- A. Provide equipment suitable for use intended.
- B. Field Offices: Prefabricated, mobile units or job-built construction with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Drinking-water fountains or containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.
- F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- H. Heating, Cooling and Humidity Control Equipment: Unless Owner authorizes use of permanent system, provide temporary equipment and systems for heating, cooling and humidity control that are adequate to comply with environmental conditions and requirements specified in other Sections of these Specifications.
 - 1. Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 2. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 3. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
 - 4. Provide temporary desiccant dehumidifiers, direct expansion dehumidifiers, chillers, cooling coils and related equipment as manufactured by Munters Corporation or other manufacturers with equivalent products for temporary cooling and control of humidity.

PART 3 - EXECUTION

3.01 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.

- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Comply with governing regulations to filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers as directed by sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
- C. Water Service: When available, use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. When not available on site install water service and distribution piping, in compliance with applicable codes, in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use. At Substantial Completion, or other designated time, remove temporary installations and restore conditions appropriate for final acceptance.
 - 2. Provide rubber hoses as necessary to serve Project site.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 - 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
 - a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.
- E. Heating and Cooling: Provide temporary heating and cooling 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 temporary weatherproof, grounded electric power service and distribution system, **in compliance with applicable codes, and** of sufficient size, capacity, and power characteristics required during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
 1. When available and Owner approves, connect temporary service to Owner's existing power source, as directed by electric company officials.
- H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office.
 2. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when on/away from Project site.

3.03 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 2. Provide incombustible construction for occupied buildings and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
 3. 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. Temporary Roads and Paved Areas: As required by conditions, construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period.
- C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
- D. Project Identification and Temporary Signs: Prepare Project identification and other signs. Install signs where directed or approved. Do not permit installation of unauthorized signs.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
- F. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.
- G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
- H. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 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. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- D. Pest Control: Minimize attraction and harboring of rodents, roaches, and other pests. When required or directed, engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- E. Site Enclosure Fence: Before construction operations begin install specified or acceptable enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- G. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to

protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

3.05 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. Protect from damage caused by freezing temperatures and similar elements.
- 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

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

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

1.03 DEFINITIONS

- A. Products: Items purchased 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, or where indicated as a product substitution, 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. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," 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 other named manufacturers.

- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.04 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
 - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 - 4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - 5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. Substitution Requests: Submit three copies 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 at the end of this Section

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications 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. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time.
 - j. Cost information, including a proposed credit in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. 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 one week of receipt of a request for substitution. Architect will notify Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

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

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 - 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store products to allow for inspection and measurement of quantity or counting of units.
 - 6. Store materials in a manner that will not endanger Project structure.
 - 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 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.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal," "or equivalent," or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Procedures for product selection include the following:
1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
 - a. Substitutions may be considered only after contract award.
 2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - a. Substitutions may be considered only after contract award.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - a. Substitutions may be considered only after contract award.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - a. Substitutions may be considered only after contract award.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
7. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified 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 provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Substitutions may be considered only after contract award.
8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product, only after contract award.
9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.

- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution, only after the Contract has been awarded and if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. 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:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 3. Substitution request is fully documented and properly submitted.
 - 4. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 5. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 6. Requested substitution is compatible with other portions of the Work.
 - 7. Requested substitution has been coordinated with other portions of the Work.
 - 8. Requested substitution provides specified warranty.
 - 9. 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.

2.03 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
 - 1. Evidence that the proposed product does not require extensive 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)

SUBSTITUTION REQUEST FORM (After contract has been awarded)

The undersigned hereby submits for consideration the following request for substitution in lieu of the specified item noted:

<u>Section</u>	<u>Page</u>	<u>Paragraph/Line</u>	<u>Specified Item</u>
_____	_____	_____	_____

Proposed Substitution: _____

Complete product description, drawings, photographs, performance and test data, samples, and other information necessary for evaluation of requested substitution is to be attached. Fill in ALL blanks.

A. Has applicable product data, performance characteristics, test results, cut sheets, drawings and other supporting documentation for substitution items been included and marked for comparison purposes? Yes ___ No __. If "No", explain : _____

B. What differences exist between the requested substitution and the specified item? _____

C. Does the requested substitution affect dimensions, locations, or configurations: Yes ___ No __. If "Yes", explain: _____

D. Will changes be required to the building or other construction in order to properly install or accommodate the requested substitution? Yes ___ No __. If "Yes", explain: _____

E. What effect does the requested substitution have on other trades? _____

F. Does the manufacturers warranty on the requested substitution differ from that specified? Yes ___ No __. If "Yes", explain: _____

- G. Does the requested substitution affect applicable code requirements? Yes ___ No ___.
If "Yes", explain: _____

- H. Will the requested substitution adversely affect the construction progress schedule?
Yes ___ No ___. If "Yes", explain: _____

- I. Will maintenance and service parts be locally available for the requested substitution?
Yes ___ No ___. If "No", explain: _____

- J. Will the requested substitution require waiving of any qualification or other requirements?
Yes ___ No ___. If "Yes", explain: _____

- K. Are there any license fees or royalties associated with the requested substitution? Yes ___
No ___. If "Yes", explain: _____

- L. Substitution Request (After Execution of Contract) - Identify monetary credit and reduction of Contract time to be realized if this Substitution Request is accepted. If none, identify specific reason under which this Substitution Request is being made. _____

- M. The undersigned will pay for Architect's (and consultants') review time, and for changes to the building design, including review, re-design, engineering, drawing and other costs, caused by the requested substitution. The following Purchase order or billing number is to be used for billing Contractor for costs incurred in evaluating, and if applicable accommodating the requested substitution:

For Contractor's use only:

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned states that the performance, function, quality and durability are equivalent or superior to the specified item. If Contractor is a corporation, the legal name of the corporation shall be set forth below, together with signature(s) of the officer or officers authorized to sign contracts on behalf of the corporation and corporate seal; if Contractor is a partnership, the true name of the firm and the name(s) of the general partner(s) shall be set forth below with the signature(s) of the partner or partners authorized to sign contracts on behalf of the partnership; and if the Contractor is an individual, his signature shall be placed below. Failure to provide legally binding signature(s) will result in non-consideration of Substitution Request (only after Contract has been awarded).

Submitted By:

(Corporate Seal)
Attest (if Corporation)

Signature, Date

Name

Title

Firm

By _____
(Signature)

Street Address

Name

City, State, Zip

Title: _____

Witnesses: _____
(if partnership or individual)

END OF SECTION

SECTION 01700
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection and correction of installed Work.
 - 8. Correction of the Work.

1.03 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- D. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework,

investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect, Construction Manager and Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

C. 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.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. 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.

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Engage a land surveyor or professional engineer to 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.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.04 FIELD ENGINEERING

- A. Identification: Identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

- A. 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. Unless required or directed otherwise, 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.

3.06 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.

3.07 PROGRESS CLEANING

- A. 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 cooler 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.

3.08 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."

3.09 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.

3.10 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.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

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

1.03 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.

1.04 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. Construction Manager'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.

1.05 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.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior curtain-wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise- and vibration-control elements and systems.
 - 7. Fire-rated assemblies.
- D. 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.
- E. 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.

1.06 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. 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.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 PERFORMANCE

- A. 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 and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Unless directed or required otherwise, 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.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents.
 - 3. Operation and maintenance manuals.
 - 4. Warranties.
 - 5. Instruction of Owner's personnel.
 - 6. Final cleaning.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic media, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.

9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and OC Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. 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.

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.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and OC Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. 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.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies 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, starting with exterior areas first.
 - 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 and OC Representative.
 - d. Name of Contractor.
 - e. Page number.

1.06 PROJECT RECORD DOCUMENTS

- A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's and OC Representative's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. 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 prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy 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. Note related Change Orders, Record Drawings, and Product Data, where applicable.

1.07 WARRANTIES

- A. Submittal Time: 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.
- 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 the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-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.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 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.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. Provide 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 following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

- j. Remove labels that are not permanent.
 - k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Replace parts subject to unusual operating conditions.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This 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. Maintenance manuals for the care and maintenance of products, materials, finishes systems and equipment.

1.03 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual is acceptable.
- B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.04 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: 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 the 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."

2.02 MANUALS, GENERAL

- 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: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
 - 6. Name, address, and telephone number of Construction Manager.
 - 7. Name and address of Architect.
 - 8. 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.
 - 1. Binders: Heavy-duty, 3-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. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. 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 CD's or diskettes for computerized electronic equipment.
 - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. 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.

2.03 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.

2.04 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.
 2. Performance and design criteria if Contractor is 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.
 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.

2.05 PRODUCT MAINTENANCE MANUAL

- 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.
- 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.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- 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 the 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed 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 videotape, 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

3.01 MANUAL PREPARATION

- A. 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.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. 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.
- D. 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.

- E. 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 1 Section "Project Record Documents."
- F. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 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.

1.03 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 two complete training manuals for Owner's use.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- 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.

1.04 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 1 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 1 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.

1.05 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

2.01 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 overhead sectional and / or coiling doors .
 - 2. Equipment, including food-service equipment.
 - 3. Fire-protection systems, equipment and accessories.
 - 4. Intrusion detection systems, if any.
 - 5. HVAC systems, including air-handling / distribution equipment and systems.
 - 6. HVAC instrumentation and controls.
 - 7. Electrical service and distribution, including as applicable, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
 - 8. Packaged engine generators, including transfer switches, if any.
 - 9. Lighting equipment and controls.
 - 10. All types of communication systems and 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.
 - l. 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

3.01 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.

3.02 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.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

END OF SECTION

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of site clearing is shown on drawings.
- B. Site clearing work includes, but is not limited to:
1. Protection of existing trees.
 2. Removal of trees and other vegetation.
 3. Topsoil stripping.
 4. Clearing and grubbing.
 5. Removing above-grade improvements.
 6. Removing below-grade improvements: disconnect and cap utility services.

1.3 JOB CONDITIONS

- A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
1. Protect improvements on adjoining properties and on Owner's property.
 2. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
1. Water trees and other vegetation to remain within limits of the contract work as required to maintain their health during course of construction operations.
 2. Provide protection for roots over 1-1/2 inches in diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Engineer. Employ licensed arborist to repair damages to trees and shrubs.
 4. Replace trees which cannot be repaired and restored to full- growth status, as determined by arborist.
- D. Improvements on Adjoining Property: Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by Owner prior to award of contract.
1. Extent of work on adjacent property is indicated on Drawings.
- E. Salvable Improvements: Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

PART 2. PRODUCTS (Not applicable.)

PART 3. EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.
1. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- B. Topsoil: Topsoil is defined as surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
 - a. Remove heavy growths of grass from areas before stripping.
 - b. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
 2. Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.
 3. Dispose of unsuitable or excess topsoil same as waste material, herein specified.
- C. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

- a. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.
 - 1. Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings, and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.
 - 2. Contact local utility companies 48 hours minimum prior to start of demolition work. Confirm verbal and written notices. Verify locations of all utilities entering site and their location on the site.
 - 3. Cooperate with owner, utility companies, adjacent property owners, and other building trades in maintaining, protecting, rerouting or extending of utilities passing through work areas which serve structures located on project site and on adjacent properties.
 - 4. Verify which utilities are to be removed, capped or abandoned are turned off, or are disconnected, or are rerouted to new locations before starting demolition.

3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning may be allowed on property with prior approval and permitting from authority having jurisdiction. All burning shall be conducted in a manner to minimize smoke and odor.
- B. Removal from Owner's Property: Remove waste materials and unsuitable, excess topsoil off site in legal manner.

END OF SECTION

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Preparing of subgrade for building slabs, walks, and structures.
 2. For preparation of pavement subgrade.
 3. For pavement subgrade stabilization and base, refer to other Division 2 sections.
- B. Excavating and Backfilling of Utility Trenches: Refer to Earthwork - Underground

1.3 DEFINITIONS

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
 2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.
1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.4 SUBMITTALS

- A. Test Reports: Submit the following reports directly to Engineer from the testing services, with copy to Contractor:
 1. Test reports on borrow and imported material.
 2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
 3. Field reports; in-place soil density tests.
 4. One optimum moisture-maximum density curve for each type of soil encountered.
 5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Owner will employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.
- C. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the Work.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are provided at the end of this specification section to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor. The geotechnical report is attached herein for reference at end of this section.
 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
 2. Contractor must adhere to procedures and recommendation outlined in the geotechnical investigation and must follow testing procedures as outlined.
- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - a. Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.
 2. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies and Owner for shutoff of services if lines are active.
- C. Use of Explosives: Use of explosives is not permitted.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
1. Operate warning lights as recommended by authorities having jurisdiction.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 3. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2. PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- C. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Fill material shall consist of sands with less than 6 percent soil fines passing No. 200 sieve.

PART 3. EXECUTION

3.1 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.2 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.3 DEWATERING

- A. Control of groundwater is required to achieve the necessary construction including earthwork, excavation, backfilling, placement of foundation and utilities. Contractor shall review the subsurface soil exploration provided for requirements of separation between bottom of any excavation or compaction surface and encountered groundwater table.
- B. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.4 STORAGE OF EXCAVATED MATERIALS

- C. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 - 2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.5 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
 - 1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3.6 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Refer to Earthwork - Underground Utilities, Section 02210.

3.8 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.9 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under grassed areas, use satisfactory excavated or borrow material.
 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
 3. Under steps, use satisfactory excavated or borrow material.
 4. Under building slabs, use satisfactory excavated or borrow material.
 5. Under sport fields and a minimum distance of 20 feet beyond the sport field limits use satisfactory fill material with maximum 3% to 5% fines in accordance with geotechnical investigation.
 6. Under playgrounds and exercise area and extending 10 feet beyond use satisfactory fill material with maximum 5% fines.
 7. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
 - a. Concrete is specified in Division 3.
 - b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
 8. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
 1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
 - a. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 98 percent maximum density.
 - b. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum density.
 - c. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.

2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
 3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Refer to construction drawings for additional requirements for grading of ballfields.
- E. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 PAVEMENT SUBBASE COURSE

- A. Refer to other Division 2 sections for preparation of subgrade, subbase, base, and paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

3.13 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or AASHTO T-180 or ASTM D 2167 (rubber balloon method), as applicable.
 - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
 - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
 2. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Engineer.
 3. Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.
 4. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.
 5. Pavement Subgrade: One field density test for each compacted layer per 10,000 sq. ft. of paved area or 250 l.f. of roadways, but no fewer than three tests per paved area.
 6. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.14 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.15 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill

material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. The work consists of excavating and backfilling all trenches and pits required for the installation of all underground utilities, pipelines, culverts, appurtenant structures and other items called for or reasonably implied in the Drawings to include sheeting and bracing, dewatering, supply and transport of fill materials, and disposal of waste materials. Appurtenant structures include headwalls, manholes, lift stations, box culverts, junction boxes, catch basins, inlets and other items related to underground systems.

PART 2 - MATERIALS

- 2.1 Bedding Material - CLASS I: ASTM D 2321, except that sizing shall be 1/4 inch to 3/4 inch. (Angular graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.)
- 2.2 Bedding Material - CLASS II: ASTM D 2321, except that upper size limit shall be 3/4 inch. (Coarse sands and gravels including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Unified Soil Classification System (USCS) soil types GW, GP, SW, and SP are included.)
- 2.3 Bedding Material - CLASS III: ASTM D 2321. (Fine sand and clay gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures, USCS soil types GM, GC, SM, and SC are included.)
- 2.4 Initial Lift Backfill: Clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or approved combination. Under no circumstances shall any muck, stumps, roots, brush, trash, rubbish or organic material be used in the backfill. Material may be selected from the excavation, or obtained, if necessary, from an approved borrow pit area. The fragment size listed below shall not be exceeded for the following pipe materials.

Fragment Size

A. Pipe Material (Greatest Dimension - Inches)

Concrete	3
Steel	3
Cast Iron	3
Ductile Iron	3
Corrugated Metal	3
Vitrified Clay	1-1/2
Plastic	1
Asbestos Cement	1/2

- 2.5 Final Lift Backfill: As described in the above paragraph, Initial Lift Backfill, except that maximum dimension for any stone or pavement fragment shall be 6 inches.
- 2.6 Sheeting and Bracing: Wood sheeting to be left in place shall be treated with preservatives per FDOT 955.

PART 3 - EXECUTION

- 3.1 General: Trenches shall be excavated to the alignment and elevations required to install utilities with proper foundations and bedding. Open no more trench in advance of pipe laying than is necessary to expedite the work.
- 3.2 Sheeting and Bracing: To prevent damage to property, injury to erosion, cave-ins, of excessive trench widths, or as required by law, adequate sheeting and bracing shall be provided. Sheeting shall be removed when the trench has been backfilled to at least one-half its depth, or when removal would not endanger the construction of adjacent structures. When required, to eliminate excessive trench width or other damage, sheeting, bracing or shoring shall be left in place and the top cut off at an elevation 2.5' below finished grade, unless otherwise specified. Wood sheeting shall not be removed from the trench region below the crown of the pipe.
- 3.3 Trench Width: The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 inches for unsheeted trench, or 12 inches for sheeted trench. Trench walls shall be maintained as vertical as possible to the top of the pipes; the maximum width of trench measured at the top of the pipe shall not exceed the outside pipe diameter plus 2', unless otherwise called for in the Drawings.
- 3.4 Unstable Trench/Pit Bottom: Where muck or other deleterious materials are encountered at or below trench grade, they shall be removed and replaced with Bedding Material in layers not to exceed 6 inches in thickness, compacted to at least 95% of maximum (AASHTO T-180) density. The Engineer may elect, depending upon the severity of the unstable soil, to require special foundations.
- 3.5 Over-Excavation: Should the trench be inadvertently over-excavated below a point 6 inches below the bottom of the pipe, but not beyond a point 12 inches below the bottom of the pipe, fill that area of over-excavation with Bedding Material and compact to 95%

of maximum (AASHTO T-180) density. Contractor shall fill any area of over-excavation beyond a point 12 inches below the bottom of the pipe with Class I Bedding material to form an impervious mat at his expense. Where the Engineer approves alternate material, compaction shall be not less than 95% of maximum (AASHTO T-180) density.

- 3.6 Noncushioned Trench Bottom: Where pipe is to be laid in a rock-cut or other noncushioned material, excavation shall allow for 6 inches of bedding beneath the pipe.
- 3.7 Excavated Materials: Ownership of all suitable excavated materials shall remain with the Owner until the final job requirement for fill or backfill materials have been fulfilled. Unless otherwise provided, any surplus materials then remaining and not needed for job requirements shall become the property of Contractor and are to be disposed of by him. Excavated material to be used for backfill shall be neatly and safely deposited at the sides of the trench/pit where space is available. All excavated material shall be stockpiled in a manner that will not endanger the work. Hydrants under pressure, water and gas valves, manhole covers, fire and police call boxes, or other utility controls shall be left unobstructed and accessible. Gutters shall be kept open or other satisfactory provisions made for street drainage, and natural water courses shall not be obstructed. Unless otherwise approved, stockpiles shall not obstruct adjacent streets, walks or driveways. Temporary store of apparent excess suitable materials in areas provided by Owner until such materials are needed in the job or are declared surplus. With the written approval of the Engineer, Contractor may dispose of such apparent excess material with the stipulation that he shall replace any portion of the disposed material required to fulfill the actual job requirements, with equally suitable material, at his own expense.
- 3.8 Dewatering: All utilities and structures shall be laid/placed, "in the dry". Dewatering shall be by well-point unless otherwise approved by the Engineer. Dewatering shall be in accordance with good standard practice and all applicable codes and regulations and must be efficient enough to lower the water level in advance of the excavation and maintain the trench or pit bottom and sides continuously firm and dry through inspection. Discharge from dewatering shall not interfere with the normal drainage of the area in which the work is being performed, create a public nuisance or form ponding.
- 3.9 Bedding: All pipe shall be bedded Class B except where Class A is called for by the Engineer. Bedding shall be in accordance with the Standard Detail Drawings and as described herein.
- A. Class B: Raise trench to above pipe grade by placement and compaction of 4 inches to 6 inches of the bedding material specified for the particular system of installation. Provide bell holes to allow continuous support along the pipe barrel. Place and compact maximum (AASHTO T-180) density to the spring line of the pipe. Where coarse materials with voids have been used for bedding, the same coarse material shall also be used for the zone up to the spring line. Avoid vertical and lateral displacement of the pipe from proper alignment.
- 3.10 Backfill-Initial Lift: Initial Lift Backfill Material, as referenced in the "Initial Lift Backfill" paragraph above, shall be carefully placed and tamped over the upper half of the utility,

and shall be carefully continued in layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the utility. Available material from the excavation shall be used if approved. The "Initial Lift" shall be thoroughly compacted and completed before the "Final Lift" is placed. Compact to 95% of maximum (AASHTO T-180) density.

- 3.11 Backfill-Final Lift: The remainder of the trench shall be backfilled with Final Lift Backfill material, as referenced in the "Final Lift Backfill" paragraph above, in layers not exceeding 12 inches. When trenches are cut in pavements or areas to be paved, compaction shall equal 98% of maximum (AASHTO T-180) density. Otherwise, compact to 95%.
- 3.12 Borrow: Should there be insufficient satisfactory material from the excavation to meet the requirements for fill material, and where borrow sites are not provided in the Contract Documents, borrow sites shall be secured by Contractor.
- 3.13 Compaction Method: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with the exception that the first two feet of backfilling over the pipe shall be compacted by manual tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered.
- 3.14 Material Disposal: Excess, unsuitable, or cleared and grubbed material, resulting from the utility installation, shall be immediately removed from the work site and disposed of. Excess excavated material shall be spread on the disposal site and graded in a manner to drain properly and not disturb existing drainage conditions. Where disposal areas are not provided in the Contract Documents, Contractor shall furnish the disposal area without additional compensation.
- 3.15 Testing: Provide density testing by a qualified independent laboratory at intervals not to exceed 250 feet.

END OF SECTION

SECTION 02214
PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work included under this Section consists of cutting, removing, protecting and replacing existing pavements.
- B. Permits: The Contractor shall obtain the necessary permits (Seminole County, "Right-of-Way Utilization Permit", State of Florida, Department of Transportation, "Utility Permit"; and other applicable authorization), prior to any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.
- C. Protection of existing improvements: The Contractor shall be responsible for the protection of all pavements, and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

1.2 JURISDICTIONAL REQUIREMENTS

- A. Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Seminole County, shall conform to the requirements of the Governmental agency having jurisdiction. Specifically, work within state highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.
- B. Portions of the Standard Specifications for Road and Bridge Construction of the Florida Department of Transportation, 1977, and Supplement thereto hereinafter referred to as the DOT Specifications, are referred to herein and amended, in part, and the same are hereby made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as though reproduced herein in their entirety.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored in equal or better condition than the original and as shown on the Drawings. The Drawings indicate minimum requirements.

- B. Materials, including soil cement, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established therefore by the DOT Specifications.
 - 1. Soil cement.
 - 2. Bituminous prime coat material shall be cutback asphalt Grade RC-70.
 - 3. Bituminous tack coat material shall be emulsified asphalt Grade RS-2.
 - 4. Asphaltic concrete shall be Type S-III.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Removals:

- 1. Pavement removal:
 - a. Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
 - b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for 10 days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to 15 days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
 - c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions. Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with the requirements set forth in the Seminole County, "Right-of-Way Utilization Regulations", and these standards.

B. Restorations:

- 1. Pavement restoration - asphalt:
 - a. Soil cement base course shall be compacted for its full thickness to not less than 95 percent of maximum density as determined by AASHTO Designation T-180. Field density of soil cement base in place shall be determined by AASHTO Designation T-191 or ASTM Designation D2922.

- b. Construction methods and equipment shall generally meet the requirements therefore as established in the DOT Specifications, but shall be modified to meet the relatively narrow strip construction conditions. Any such modifications shall be accepted by the Engineer prior to their use.
- c. After the application of the prime coat on the base, the prime coat shall be allowed to cure without sanding for a period of 24-hours. The Contractor shall take all necessary precautions to protect the primed surface against damage during this interval. If, at the end of 24-hours, it is not proposed to proceed at once with the application of the surface course, primed surface shall be given a light application of clean sand and opened to traffic.
- d. Joints with existing surface and base shall be straight and neat. If necessary to obtain a straight net joint, the Contractor shall cut out sufficient existing material and replace it with new material.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All erosion, sedimentation and water pollution control features shall be in place or relocated as designated on the plans prior to the start of any clearing, grubbing, grading or construction. Contractor shall be responsible for the installation and maintenance of all temporary erosion control features.
- B. Location of the control features shall be in accordance with the Drawings or as required to facilitate drainage and control erosion and sedimentation within and adjacent to the site.
- C. Control features are defined as, but not limited to, swales, berms, silt fences, silt barriers and temporary fences.

1.2 QUALITY ASSURANCE

- A. The provision for prevention, control and abatement of erosion, sedimentation and water pollution shall be as stated in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104, latest edition.

1.3 SUBMITTALS

- A. Product data: Manufacturers literature, application instructions and samples.
- B. List of materials and their characteristics for other erosion control items.

1.4 CONTROL OF CONTRACTOR'S OPERATIONS WHICH MAY RESULT IN WATER POLLUTION

- A. Take sufficient precautions to prevent pollution of streams, canals, lakes, reservoirs, wetlands and other sensitive areas with silt, sediment, fuels, oils, bitumens, calcium chloride, or other harmful materials. Conduct and schedule operations so as to avoid or otherwise minimize pollution or siltation of such streams, etc. and to avoid interference with movement of migratory fish. Do not dump the residue from dust collectors or washers into any water body.
- B. Construction operations in rivers, streams, lakes, tidal waters, reservoirs, canals, and other impoundments shall be restricted to those areas where it is necessary to perform filling or excavation to accomplish the work shown in the Contract Documents and to those areas which must be entered to construct temporary or

permanent structures. As soon as conditions permit, promptly clear rivers, streams, and impoundments of all obstructions placed therein or caused by construction operations.

- C. Except as necessary for construction, do not deposit excavated material in rivers, streams, canals, or impoundments, or in a position close enough thereto, to be washed away by high water or run-off.
- D. Where pumps are used to remove highly turbid waters from enclosed construction areas such as cofferdams or forms, treat the water prior to discharge into State waters. Pump the water into grassed swales, appropriately vegetated areas, or sediment basins, or confine it by an appropriate enclosure such as siltation curtains when other methods are not considered appropriate. Do not contaminate State waters. The background condition of all waters to be discharged from the site must be tested prior to discharge. All waters discharged from the site must be approved through Orange County Environmental Department by the Engineer.
- E. Do not disturb lands or waters outside the limits of construction, unless approved in advance and in writing by the Owner. No operations within non-permitted wetlands or upland buffers are allowed.

1.5 START OF WORK

- A. Do not start work until erosion control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Silt Barriers:
 - 1. Two types of silt barriers shall be installed in accordance with the plans: silt barriers installed on the ground and floating silt barriers.
 - 2. Silt barriers (filter fabric) shall be synthetic and contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 to 120EF.
 - 3. Filter fabric shall be a pervious sheet of propylene, nylon or polyester and shall be certified by the manufacturer or supplier to conform to the following specifications:
 - Filter efficiency (Test VTM-51): 75%.
 - Minimum tensile strength at 20% elongation (Test ASTM-D-1682): 120 lbs.
 - Tear strength (Test ASTM D2263): 50 lbs.
 - 4. Contractor shall submit further filter fabric material specifications and installation configuration prior to start of construction.
 - 5. Silt barriers shall be maintained in place.
 - 6. Filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter fabric shall be spliced together only at a support post, with a 6 inch overlap, and securely sealed.

7. The following items shall be installed and maintained in accordance with the applicable sections of the FDOT Standard Specifications:
 - a. Temporary silt fences and staked silt barriers
 - b. Floating silt barrier
- B. Temporary Fence
 1. Brightly colored fence as manufactured by Mirafi, product Mirasafe, or approved equal.
 2. Material shall be 4' high, attached to 6' metal posts at 12' centers. Posts shall be driven 18" into ground.

PART 3 - EXECUTION

3.1 GENERAL

- A. Temporary erosion control features shall consist of, but not be limited to, temporary grassing, temporary sodding, temporary mulching, sandbagging, slope drains, sediment basins, artificial coverings, berms, baled hay or straw, floating silt barriers, staked silt barriers and staked silt fences. Design details for some of these items may be found in the Water Quality Section of the applicable edition of the FDOT Roadway and Traffic Design Standards. All of these items shall be constructed in accordance with applicable sections of the FDOT Standard Specifications.
- B. Incorporate permanent erosion control features into the project at the earliest practical time. Correct conditions, using temporary measures, that develop during construction to control erosion prior to the time it is practical to construct permanent control features.
- C. Construct temporary and permanent erosion and sediment control measures and maintain them to prevent the pollution of adjacent water ways in conformance with the laws, rules and regulations of Federal, State and local agencies.
- D. Copies of approved permits will be provided to the Contractor for his review and use. Contractor shall be required to comply with all General and Special Conditions noted within the permit by the particular permitting agency. The Contractor shall maintain copies of these permits on the job site at all times.

3.2 INSTALLATION

The following items shall be installed in accordance with the FDOT Standard Specification. The procedures are only generally described herein.

- A. Temporary Grassing: This work shall consist of furnishing and placing grass seed.
- B. Temporary Sod: This work shall consist of furnishing and placing sod.

- C. Temporary Mulching: This work shall consist of furnishing and applying a two-inch to four-inch thick blanket of straw or hay mulch and then mixing or forcing the mulch into the top two inches of the soil in order to temporarily control erosion. Only undecayed straw or hay, which can readily be cut into the soil, shall be used. Other measures for temporary erosion control such as hydro-mulching, chemical adhesive soils stabilizers, etc., may be substituted for mulching with straw or hay with the approval of the Owner. When permanent grassing operations begin, temporary mulch materials shall be plowed under in conjunction with preparation of the ground.
- D. Sandbagging: This work shall consist of furnishing and placing sandbags in configurations, so as to control erosion and siltation.
- E. Slope Drains: This work shall consist of constructing slope drains, utilizing pipe, fiber mats, rubble, cement concrete, asphaltic concrete plastic sheeting, or other acceptable materials, in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as may be approved as suitable to adequately perform the intended function.
- F. Sediment Basins: Sediment basins shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as suitable to adequately perform the intended function. Sediment basins shall be cleaned out as necessary.
- G. Artificial Coverings: This work shall consist of furnishing and applying fiber mats, netting, plastic sheeting, or other approved covering to the earth surfaces.
- H. Berms: This work shall consist of construction of temporary earth berms to divert the flow of water from an erodible surface.
 - 1. This work shall consist of construction of baled hay or straw dams or earth berms to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards.
 - 2. The berm or dam shall be placed so as to effectively control silt dispersion under conditions present on this project. Alternate solutions and usage of materials may be used if approved.

3.3 SILT BARRIERS

- A. Silt barriers shall be installed and maintained at the locations shown on the plans. The Contractor is required to prevent the possibility of silting onto any adjacent parcel.
- B. Silt barrier shall be of the staked type and stakes shall be installed as indicated in the drawings.
- C. The height of the silt barrier fabric shall be a minimum of 42 inches.

- D. The stakes shall be 2 inch x 4 inch wood, 5 feet long and shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground.
- E. A trench shall be excavated approximately 4 inches wide by 4 inches deep along the line of stakes. The filter fabric shall be tied or stapled to the wooden stakes and 8 inches of fabric shall be extended into the trench. The staples shall be heavy duty wire and at least one-half (1/2) inch long. The trench shall then be backfilled and the soil compacted over the filter fabric.

3.4 FLOATING SILT BARRIERS

- A. Floating silt barriers where required shall be in place prior to the start of any construction or grading.
- B. Floating silt barriers shall meet or exceed the Florida Department of Transportation Roadway and Traffic Design Standards, Index No. 102, Floating Silt Barrier. Contractor shall submit fabric filter material specifications and installation configuration for approval prior to the start of construction.

3.5 TEMPORARY FENCE

- A. Furnish, install and maintain on wetland lines, buffer lines, tree save lines and otherwise as shown on plans. Attach silt barrier to the temporary fence.
- B. Follow manufacturer's installation recommendations.

3.6 MAINTENANCE

- A. Silt barriers and temporary fences shall be inspected immediately after each rainfall and at least once a day during periods of prolonged rainfall. Any repairs shall be made immediately.
- B. Should the fabric on a silt barrier or temporary fence decompose or become ineffective, the installation shall be repaired or replaced immediately at no additional cost to the Owner. If the Contractor fails to repair or replace the items as above, the Owner shall have the right to stop work without additional cost to the Owner until such time as the repair or replacement has been made.
- C. Sediment deposits shall be removed after each storm event. The Contractor will repair and restore the installations to a working and effective condition to the satisfaction of the Owner.
- D. At the completion of all work, the silt barriers and the temporary fences will be removed if by the Owner.

- E. Any sediment deposits in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade and prepared for seeding or sodding.

3.7 PROTECTION DURING SUSPENSION OF CONTRACT TIME

- A. In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit run-off of rainwater and construct earth berms along the top edges of embankments to intercept run-off water. Provide temporary slope drains to carry run-off from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes and impoundments. Should such preventative measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Stabilize the designated portions of the pavement subgrade in both cut and fill sections to provide a firm and unyielding subgrade to the uniformity, density, bearing value, lines, grades and thicknesses herein specified or shown in the Drawings. The work includes mixing, compacting and grading for a complete job.

PART 2 - MATERIALS

- 2.1 Local Materials: High bearing-soils or sand clay material. The materials passing the #40 mesh sieve shall have a liquid limit not greater than 30, and a plasticity index not greater than 10. Blending materials to meet these requirements will not be permitted unless authorized by the Engineer. When so permitted, the blended material shall be tested and approved before spreading.
- 2.2 Limerock/Limerock Overburden: The percentage of carbonates of Calcium and magnesium shall be at least 70, and plasticity index shall not exceed 10. The gradation shall be such that 97% by weight of the material will pass a 1" sieve.
- 2.3 Crushed Shell: Mollusk shell, but not steamed shell, (i.e., oysters, mussels, clams, cemented coquina, etc.). Gradation shall be such that at least 97% by weight of the total material passes a 1" sieve, and at least 50% by weight is retained on the #4 sieve. Not more than 20% by weight of the total material shall pass (by washing) the #200 sieve.

PART 3 - EXECUTION

- 3.1 Required Florida Bearing Value (FBV): Unless otherwise specified, the subgrade shall have a minimum Florida Bearing Value of 70. Where local material does not conform to the required FBV, stabilize by uniformly mixing with satisfactory local or hauled in material to the depth shown in the Drawings. Perform bearing value determination per FDOT standard specifications for Road and Bridge Construction, section 160-8.1.
- 3.2 Compaction: Compact the stabilized subgrade in both cuts and fills to a minimum density of 98% of maximum (AASHTO T-180) density. The subgrade shall be shaped to within 1/4 inch of the grades shown in the Drawings.

- 3.3 Maintenance: After the subgrade has been prepared as specified, Contractor shall maintain it free from ruts, depressions and all damage resulting from hauling or handling of any materials, equipment, tools, etc. All work which may become necessary in order to recompact the subgrade shall be at contractor's expense.
- 3.4 Testing: Provide density and bearing value tests at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Construct limerock base course on the prepared subgrade as specified herein and in conformance with the lines and grades shown in the Drawings.

PART 2 - MATERIALS

- 2.1 Limerock: FDOT 200-2.

PART 3 - EXECUTION

- 3.1 Spreading: Uniformly spread limerock by mechanical rock spreader, equipped with a device which strikes off uniformly to laying thickness, and is capable of even distribution. Where a mechanical spreader is not practical such as crossovers, intersections and ramp areas; roadway widths of 20 feet or less; and main roadway areas when forms are used, spreading may be done by bulldozers or blade graders. Remove and replace all segregated areas of fine or course rock with properly graded rock.
- 3.2 Transportation: Transport limerock to the point of use over rock previously placed, and dump on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will not be permitted.
- 3.3 Courses: Construct bases of specified compacted thickness greater than 6 inches in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.
- 3.4 Compacting and Finishing: Clean the lower course (where applicable) of foreign material, blade the surface to a cross-section approximately parallel to the finished base. The lower course shall be tested for density prior to spreading the upper course. After the upper course has been spread, scarify and shape the surface to produce the required grade and cross-section after compaction, free of scabs and laminations.
- 3.5 Moisture Content: Material not having the proper moisture content to insure the required density, shall be wetted or dried as required. Mix-in added water uniformly by disking to the full depth of the course. Wetting and drying operations require manipulation, as a unit, of the entire width and depth of the course which is to be compacted.
- 3.6 Density Requirements: After attaining proper moisture conditions, compact to a density of not less than 98 percent of maximum (AASHTO T-180) density.

- 3.7 Correction of Defects - If, at any time, the subgrade material should become mixed with the base course material, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as cited herein.

Cracks or checks appearing in the base, either before or after priming, which would impair the structural efficiency of the base, shall be removed by rescarifying, reshaping, adding base material, recompacting and repriming without additional compensation.

- 3.8 Priming and Maintaining: Apply the prime coat only when the base meets the specified density requirements, and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Maintain the true crown and template, with no rutting or other distortion, and insure that the base meets all requirements at the time the surface course is applied.

- 3.9 Surface Requirement: Irregularities greater than 1/4 inch, when checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center of the roadway, shall be corrected by scarifying and removing or adding rock as required and recompacting the entire area as specified.

- 3.10 Thickness Requirement: Where the base is deficient by more than 1/2 inch, it shall be reworked to the area extent specified by the testing laboratory and to a depth of at least 3 inches by scarifying and adding more base material, so that after proper compaction the thickness will conform to the Drawings.

- 3.11 Testing Density: Provide three density determinations on each day's final compaction operation on each course. Blading to grade where required shall be completed prior to density testing.

A. Surface: Check the finish surface of the base course with a template cut to the required crown and with a 15-foot straight edge laid parallel to the center of the roadway.

- 3.12 Thickness: Provide test holes at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of asphalt concrete paving work is shown on drawings.
- B. Prepared aggregate subbase and base is specified in "SUBGRADE STABILIZATION," "LIMEROCK" Sections.
- C. Prepared subgrade is specified in "EARTHWORK" Section.
- D. Saw-cutting of edges of existing pavement is specified in site clearing section.

1.3 SUBMITTALS

- A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

PART 2 - PRODUCTS

2.1 MATERIALS

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

- A. Type S Asphaltic Concrete: FDOT, 331-2, 3, 4, 5.
- B. Type III Cement Asphaltic Concrete: FDOT, 333-2, 3, 4 and 5.
- C. Asphalt Cement: FDOT, 916-1

- D. Prime Coat: Cut-back asphalt grade RC-70 or RC-250 per FDOT 916-2; emulsified asphalt grade SS-1 or SS1H, per FDOT 916-4, diluted in equal proportions with water; or other types and grades of bituminous material.
- E. Tack Coat: Emulsified asphalt; RS-2, SS-1, or SS-1H (diluted in equal proportions with water) per FDOT 916-4. Cut-back asphalt RL-70, or asphalt cement, penetration grade 85-100.
- F. Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO M 248 (FS TT-P-115), Type III or per FDOT 971-12.2.
- G. Thermoplastic Traffic Stripes and Markings: Per FDOT standard specifications for Road and Bridge Construction, Section 711.
- H. Wheel Stops: Precast of 3,500 psi air-entrained concrete, approximately 6 inches high, and 6 feet 0 inches long, with chamfered corners and drainage slots on underside.

2.2 ASPHALT-AGGREGATE MIXTURE AND PREPARATIONS

- A. FDOT 330-5, and FDOT 330-6.

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. Mixture shall not be spread when the air temperature is not greater than 40° F, in the shade (away from artificial heat), or there is evidence of a frozen base, or when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved.

Any mixture caught in transit by a sudden rain may be laid only at Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced at Contractor's expense. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

3.2 PREPARATION OF ASPHALT CEMENT

- A. Heat the asphalt cement in advance of the mixing operations, to within a range of 270° F to 350° F. Maintain the heating operations constant within these limits. Wide temperature fluctuations during the day will not be permitted.

3.3 PREPARATION OF AGGREGATE

FDOT 330-5

3.4 PREPARATION OF MIXTURE

FDOT 330-6

3.5 TRANSPORTATION OF MIXTURE

Transport the mixture in vehicles clean of foreign material properly equipped to be covered during inclement weather. Coat the inside surfaces of the truck with soapy water or approved emulsion containing less than 5 percent oil (not kerosene, gasoline or similar products) and raise beds to drain excess prior to loading.

3.6 PREPARATION OF APPLICATION SURFACES

- A. Cleaning: Thoroughly clean the surface to be covered of all loose and deleterious material before laying any mixture.
- B. Patching and Leveling Courses: Where a surface course is constructed on an existing pavement or base and/or where called for in the Drawings, apply patching or leveling courses to bring the existing surface to proper grade and cross-section. Prior to spreading leveling courses, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture, and then thoroughly compacted.
- C. Coating Surfaces of Contacting Structures: Paint all structures such as manholes, inlet, valve boxes, etc., with a uniform coating of asphaltic cement.
- D. Prime Coat: Prime materials shall be uniformly applied using a pressure distributor at the minimum rates of 0.10 gallons per square yard for limerock, limerock stabilized and local rock bases, and 0.15 gallons per square yard for sand, clay, shell and shell stabilized bases. The actual amount to be applied shall be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly without having any access to form pools or to flow off the base. The temperature of the prime material shall be that temperature between 100° F and 150° F, which will insure uniform distribution. The moisture content of the base shall not be greater than 90 percent of optimum to obtain adequate penetration.

Apply a light uniform application of cover material and roll with a traffic roller for at least 10 passes before opening to traffic. Where an emulsified asphalt is used for prime coat, the Engineer may require that cover material be hot-asphalt coated with two to four percent asphalt-cement, if necessary, to achieve a prime coat which will remain reasonably intact until the surface course is placed; the application rate shall be approximately 10 pounds per square yard.

3.7 TACK COAT

A tack coat will only be required on primed bases in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime has cured to the extent that it has lost adequate bonding effect. Generally, a tack coat will be required on bituminous base or leveling courses before placing the surface course.

Apply tack, suitably heated, at the minimum rate necessary to bond the wearing surface to the base (between 0.02 and 0.08 gallons per square yard). The upper limit may be exceeded for resurfacing concrete. Apply tack sufficiently in advance of the wearing course to permit drying but not so far in advance to allow loss of adhesiveness from dust and other foreign material. No traffic shall be allowed on the tacked surface.

3.8 PLACING MIXTURE

- A. Mixture shall be placed and spread only after the surface to be overlaid is properly prepared, intact, firm, properly cured and dried. No mixture shall be spread that cannot be finished and compacted during the daylight hours of day of spreading.

Spread the mixture with mechanical spreaders, except where impracticable. A stringline shall be used to obtain an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be between 270° F and 350° F.

1. Checking Depth of Layer: The depth of each layer shall be checked by the Contractor at intervals, not to exceed 25 feet. Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.

- B. Surface Courses:

1. Spreading and Finishing: Immediately upon arrival, the mixture shall be dumped into the spreader, spread and struck-off to the full width required and to such loose depth to secure the specified thickness. Excess mixture shall be carried ahead of the screed at all times. Hand rake behind the machine as required.
2. Thickness of Layers: Surface courses of thickness greater than two inches, shall be constructed in approximately equal layers and of less than two inches compacted thickness. Each layer shall be thoroughly compacted and shall conform to these specifications prior to overlaying.
3. Correcting Defects: Prior to rolling, the surface shall be checked, and irregularities adjusted. All drippings, fat sandy accumulations from the screed, and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. Where a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

- C. Leveling Courses:

1. Spreading: The initial and intermediate leveling courses shall be placed by a spreader box, working conjunction with two motor graders. The final leveling course shall be placed by a paving machine. However, if the total quantity of leveling to be applied is less than 150 pounds per square yard, the paving machine may not be required.
2. Application Rates: The application rate of leveling mixture shall not exceed 50 pounds per square yard per course except Type S-1 asphaltic concrete leveling shall not exceed 75 pounds per square yard per course. The actual application rate shall be as required to establish the finished lines and grades shown in the Drawings and shall not be limited to any average or typical rate or thickness which may be shown in the Drawings.

3. Leveling Over Existing Concrete Pavement: Remove all excess joint filler to flush with the existing pavement. For broken concrete pavement (with or without existing asphalt surface) the first leveling course shall be placed as soon after, but not later than 2 days after, the cracking and reseating operation.

3.9 COMPACTING MIXTURE

Density required for asphaltic concrete pavement, after final compaction, shall be at least 95 percent of the laboratory compacted density of the paving mixture. Tests shall be performed every 500 feet for roadways and 50,000 square feet for parking areas.

- A. Equipment and Sequence: For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with operators. The rolling shall be done in sequence, and with the equipment as follows, unless otherwise permitted by the Engineer:
 1. Seal Rolling - Use tandem steel rollers weighing 5 to 12 tons, following as close behind the spreaders as is possible without pick-up, undue displacement or blistering of the material.
 2. Rolling with Traffic Roller - Use self-propelled pneumatic-tired rollers, 6 to 10 tons and tire pressure to 55 pounds, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five passes.
 3. Final Rolling - Use tandem steel roller, weighing 8 to 12 tons after the pneumatic-tired rolling has been completed, but before the pavement temperature has dropped below 140° F.
- B. Compaction of Crossovers, Intersections, etc.: Where a separate paving machine is used to pave crossovers, compaction may be done by one 8 to 10 ton tandem steel roller. If crossovers, intersections and acceleration and deceleration lanes are placed with the main run of paving, a traffic roller shall also be used in the compaction.
- C. Rolling Procedures: The rolling shall be longitudinal. Where the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to rolling of the rest of the lane. Continue across the mat, overlapping each previous roller path by at least one-half the width of the roller wheel. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be corrected at once by the use of rakes, and the addition of fresh mixture if required. Final rolling shall continue until all roller marks are eliminated.

Self-propelled, pneumatic-tired traffic rollers shall proceed at a speed of 6 to 10 miles per hour; the area covered by each roller shall not exceed 4,000 square yards per hour, except that for Type S-1 Asphaltic Concrete, the maximum shall be 3,000 square yards per hour.

- D. Number of Traffic Rollers Required: A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling will not delay any other phase of the laying operation nor result in excessive cooling of the mixture. In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
- E. Rolling Patching and Leveling Courses: Use self-propelled pneumatic-tired rollers for all patching and leveling courses. Where the initial leveling course is placed over broken concrete pavement, the pneumatic-tired rollers shall weight at least 15 tons. For Type S-I Asphaltic Concrete leveling courses, use a steel-wheeled roller, to supplement the traffic rollers. The use of a steel-wheeled roller will otherwise be at Contractor's option.
- Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, manholes, etc.) shall be compacted by the use of hand tamps or other satisfactory means.
- F. Correcting Defects: Rollers shall not deposit gasoline, oil or grease onto the pavement. Any areas damaged by such deposits shall be removed and replaced. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depressions remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, joints and honeycomb shall be corrected. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area. Areas of defective surface may be repaired by the use of the indirect heat. No method of repair involving open-flame heaters shall be used.
- G. Provisions Applicable to Shoulder Pavement Only: Where sand-asphaltic shoulders are constructed within the limits of curb and gutter, compaction shall be done by light weight rolling equipment, which will not displace the previously constructed curb and gutter.

3.10 JOINTS

- A. Fresh mixture shall be laid against the exposed edges at joints (trimmed or formed as provided below) in close contact with the exposed edge so that an even, well-compacted joint will be produced after rolling.
1. Transverse Joints: Placing of the mixture shall be as continuous as possible. The roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become

- chilled. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.
2. Longitudinal Joints: Where a portion of the width of pavement is to be laid and opened to traffic, longitudinal joints shall be formed by rolling the exposed edge of the strip first laid. When the adjacent strip is constructed, the Engineer may require the edge of the mixture in place to be trimmed back to expose an unsealed or granular vertical surface. Where the strip first laid is closed to traffic, the edge shall not be sealed but shall be left vertical and the adjacent strip placed against it without trimming.

3.11 SURFACE REQUIREMENTS & CORRECTION:

- A. The finished surface shall not vary more than 3/16 inch when measured by rolling or manual straightedge applied parallel to the center line of the pavement. Any surface irregularities exceeding such limits shall be corrected as specified herein.
 1. Manual Straightedging: A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at all times on the work. The Contractor shall designate an employee whose duty it is to handle the straightedge in checking the compacted surfaces.
 2. Texture of Finished Surfaces: The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn or loosened portions, and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.) Defective area shall be corrected as follows:
 - a. If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.
 - b. If the correction is made by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness (featheredged) at the end of a minimum length of 50 feet each side of the defective area.

3.12 PROTECTION OF FINISHED SURFACE

- A. Finished surfaces including courses to be overlaid shall be kept clean and no dumping of any material onto the surfaces shall be permitted. Protect pavement against damage during shoulder construction by providing proper attachments to grader blades. Vehicular traffic shall not be permitted until the pavement has set sufficiently to prevent rutting or other distortion.

3.13 TRAFFIC AND LANE MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.
 1. Color: white and yellow as indicated on drawings.

- a. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates.

3.14 WHEEL STOPS

- A. Secure wheel stops to asphalt concrete surface with not less than two 3/4 inch diameter steel dowels embedded in precast concrete at 1/3 points. Size length of dowel to penetrate at least 6 inches into asphalt concrete. Drill placement holes oversize and embed dowels in hot bituminous grout material.

3.15 FIELD QUALITY CONTROL

A. THICKNESS REQUIREMENTS & CORRECTIONS

- 1. Pavement thickness shall be determined from the length of the core borings as specified herein. The maximum allowable deficiency from the specified thickness and serious deficiency thickness shall be as follows:
 - a. Pavement of specified thickness 1 1/2 inches or less
 - Maximum allowable deficiency 3/16 inch or more
 - Serious deficiency 1/4 inch or more
 - b. Pavement of specified thickness greater than 1 1/2 inches but less than 2 1/2 inches
 - Maximum allowable deficiency 1/4 inch or more
 - Serious deficiency 3/8 inch or more
 - c. Pavement of specified thickness 2 1/2 inches or greater
 - Maximum allowable deficiency 1/2 inch or more
 - Serious deficiency 3/4 inch or more
- 2. Contractor shall correct seriously deficient areas either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the Engineer) by overlaying as specified herein at his own expense.

As an exception to the above, pavement outside a main roadway area (acceleration and deceleration lanes, crossovers and parking areas) may be left in place, without compensation (except for payment for the bituminous material), when so permitted by the Engineer, even though the thickness deficiency exceeds the serious deficiency tolerance specified above.

Where the deficiency exceeds allowable but does not exceed serious, Contractor will be allowed to leave such pavement in place, but without compensation other than for the bituminous material contained therein. The areas of such pavement for which no square yard payment will be made shall be the product of the total distance between acceptable cores, multiplied by the width of the lane which was laid at the particular pass in which deficient thickness was indicated. To determine the extent of the deficiencies, additional cores will be taken as required.

3. Correcting Deficiency by Adding New Surface Material: For any case of excess deficiency of the pavement, Contractor will be permitted, if approved by the Engineer for each particular location, to correct the deficient thickness by adding new surface material and compacting to the same density as the adjacent surface. The area to be corrected and the thickness of the new material added shall be as specified herein. All costs of the overlaying and compacting shall be borne by the Contractor.

B. CALCULATION FOR THICKNESS OF PAVEMENT

1. Core Borings: The thickness of the pavement shall be determined from the length of cores, at least two inches in diameter, taken at random points along the roadway and the parking areas. Each core shall represent a roadway section not longer than 500 feet or a parking area not less than 10,000 square feet. The average thickness shall be determined from the measured thicknesses, and in accordance with the procedure and criteria specified herein.

If it is found that the specified pavement thickness has not been installed per this specification and if Contractor believes that the number of cores taken by the Owner is insufficient to properly indicate the thickness of the pavement, he may request the owner make additional borings at locations designated by him. The cost of these additional borings shall be deducted from any sums due Contractor unless such borings indicate that the pavement within the questioned area is of specified thickness.

2. Criteria for Calculations:
 - a. Average thickness shall be calculated for the total length of project.
 - b. When the thickness as measured by the cores is more than 1/2 inch greater than the specified thickness, it shall be considered in the calculation as the specified thickness plus 1/2 inch.
 - c. Areas of deficient thickness pavement which are left in place with no compensation shall not be taken into account in the calculations.
 - d. Where areas of defective surface or deficient thickness are corrected by overlaying with additional material, the thickness used in the calculations shall be the specified thickness for such areas.

C. TESTING

1. The contractor shall provide, at his expense, the following tests before stating any laying operations:
 - a. Determination of the job mix formula
 - b. Tests of the asphalt cement
 - c. Sieve analysis of the aggregate
 - d. Determination of bitumen content of the asphalt concrete

END OF SECTION

SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving is shown on drawings, including curbs, gutters, walkways and pavement.
- B. Prepared subgrade is specified in "EARTHWORK" section.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.4 SUBMITTALS

- A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

1.5 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat forms with a non-staining form release agent that will not discolor or deface

surface of concrete.

- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.
 - 1. Furnish in rolls, unless otherwise acceptable to Architect.
- C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
- D. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends square and free of burrs.
- E. Metal Expansion Caps: Furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3 inches to allow bars movement of not less than 1 inch, unless otherwise indicated.
- F. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Concrete Materials: Comply with requirements of applicable Division-3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- H. Expansion Joint Materials: Comply with requirements of applicable Division-7 sections for preformed expansion joint fillers and sealers.
- I. Anti-Spalling Compound: 50% (by volume) boiled linseed oil and 50% (by volume) mineral spirits, complying with AASHTO M-233.
- J. Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - "Masterseal"; Master Builders.
 - "A-H 3 Way Sealer"; Anti-Hydro Waterproofing Co.
 - "Ecocure"; Euclid Chemical Co.
 - "Clear Seal"; A.C. Horn.
 - "J-20 Acrylic Cure"; Dayton Superior.
 - "Sure Cure"; Kaufman Products Inc.
 - "Spartan-Cote"; The Burke Co.

"Sealkure"; Toch Div. - Carboline.
"Kure-N-Seal"; Sonneborn-Contech.
"Polyclear"; Upco Chemical/USM Corp.
"L&M Cure"; L & M Construction Chemicals.
"Klearseal"; Setcon Industries.
"LR-152"; Protex Industries.
"Hardtop"; Gifford - Hill.

- K. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
- "J-40 Bonding Agent"; Dayton Superior Corp.
"Weldcrete"; Larsen Products.
"Everbond"; L & M Construction Chemicals.
"EucoWeld"; Euclid Chemical Co.
"Hornweld"; A. C. Horn.
"Sonocrete"; Sonneborn-Contech.
"Acrylic Bondcrete"; The Burke Co.
- L. Epoxy Adhesive: ASTM C 881, two component materials suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
- "Epoxitite"; A. C. Horn.
"Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
"Sikadur Hi-Mod"; Sika Chemical Corp.
"Euco Epoxy 463 or 615"; Euclid Chemical Co.
"Patch and Bond Epoxy"; The Burke Co.
"Sure-Poxy"; Kaufman Products Inc.

2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable Division-3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing of high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.
2. Slump Range: 8 inches for concrete containing HRWR admixture (super-plasticizer); 3 inches for other concrete.
3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Remove loose material from compacted subgrade surface immediately before placing concrete.

Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 FORM CONSTRUCTION

- A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 12 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

- A. Locate, place and support reinforcement as specified in Division-3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

- A. General: Comply with requirements of Division-3 sections for mixing and placing concrete, and as herein specified.

1. Do not place concrete until subbase and forms have been checked for line and

grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2 inches overlap to adjacent mats.

Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

- a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

3.5 JOINTS

- A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

1. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:
 - a. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.
 - a. Construct joints as shown or, if not shown, use standard wood or metal keyway-section forms.
 - b. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.
3. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints at spacings indicated.

Extend joint fillers full-width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

4. Fillers and Sealants: Comply with the requirements of applicable Division-7 sections for preparation of joints, materials, installation, and performance.

3.6 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

Do not remove forms for 12 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.7 CURING

- A. Protect and cure finished concrete paving, complying with applicable requirements of Division-3 sections. Use membrane- forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Architect.
- B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Pavement markings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Asphalt concrete paving - Section 02513

1.3 SUBMITTALS

- A. Procedure: Submit in accord with General Conditions.
- B. Product data: Submit manufacturer's detailed literature.

PART 2 - MATERIALS

- 2.1 A. Pavement marking paint: Tnemec's Traffic Paint, Glidden-Durkee's Romark Traffic, PPG's Traffic and Zone Marking
 - 1. Provide marking paint for perimeter and marking outside traffic flow patterns or in areas where existing markings have been disturbed.

PART 3 - EXECUTION

3.1 PAINT MARKINGS APPLICATION

- A. Obtain approval of marking layouts prior to paint application.
- B. Traffic line markings: 4 inches wide unless otherwise indicated.
- C. Machine apply in strict accord with recommendations of paint manufacturer.
- D. Apply two coats or more as required for complete opacity.
 - 1. Apply first coat after all paved surfaces to be painted are dry and cured for a minimum of 48 hours.
 - 2. Apply second or final coat prior to completion of project.
- E. Paint directional lettering, arrows and other markings by similar methods with same paint. Use stencils and masking tape as required to achieve required designs.

END OF SECTION

SECTION 02580
CONCRETE CURBS AND WALKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

A. General: Furnish all labor and materials to construct concrete curbs and gutters, sidewalks including ramps, and driveways as called for in the Drawings and detailed in the Standard Detail Drawings to include excavation and backfill; foundation; and forming, placing, jointing, form removing, finishing and curing concrete.

PART 2 - MATERIALS

2.1 Concrete: FDOT 345-2 (except no pozzolan), 4, 6, 9, 10, 11, 12, 13. Class I concrete with minimum 28-day compressive strength of 3000 psi.

2.2 Reinforcement: ASTM A615 - Grade 60.

2.3 Joint Materials: FDOT 932-1.

2.4 Membrane Curing Compound: FDOT 925-2.

2.5 Forms: Forms shall be metal or wooden, straight, and free from warp or bends and of sufficient strength, when staked to resist the pressure of the concrete without deviation from line and grade. Flexible forms shall be used for all items constructed on a radius.

PART 3 - EXECUTION

3.1 Foundation (Subgrade Preparation): The subgrade shall be excavated or filled with suitable material to the required grades and lines. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted to a minimum of 95% of maximum (AASHTO T-180) density and extend to a minimum of 1 foot outside the form lines. The subgrade shall be dense, firm, trimmed to a uniform smooth surface, and in a moist condition when the concrete is placed.

3.2 Machine Laid Curb: The slipform/extrusion machine approved shall be so designed as to place a spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall be operated with as nearly a continuous forward movement as possible. All operations

- of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.
- 3.3 Forming: Depth of forms shall be equal to the Drawing dimensions for the concrete to be placed against them. Forms shall be staked to resist the pressure of the concrete without deviation from line and grade. They shall be cleaned each time used and shall be oiled or saturated with water prior to placing concrete.
- 3.4 Reinforcement: Reinforcement shall only be required where called for in the Drawings. Set reinforcement for sidewalks above the foundation so concrete will flow under it.
- 3.5 Placing: Place concrete in the forms and tamp and spade to prevent honeycomb until the top of the structure can be floated smooth. Round all edges to 1/2 inch radii unless otherwise shown on the Standard Detail Drawings.
- 3.6 Sidewalk Ramps: Ramps shall be provided at all road/street crossings each way as shown in the Standard Detail Drawings.
- 3.7 Contraction Joints: Unless otherwise shown or noted in the Drawings, weakened plane contraction joints shall be located as follows:
- Curbs - 10 feet maximum intervals.
- Sidewalks - To form squares of uniform size.
- 3.8 Contraction joints may be sawed, hand-formed, or made by 1/8 inch thick division plates in the framework. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand-formed by using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete. Where division plates are used, the plates shall be removed after the concrete has set and while the forms are still in place.
- 3.9 Expansion (Isolation) Joints: Provide isolation joints between all distinct structures such as between sidewalk and curbs, driveway and sidewalk or curbs, sidewalk or curbs and inlets, around concrete utility poles and at radius points along the curbs and at the end of a continuous pour.
- 3.10 Finishing: Strike off concrete sidewalks and driveways by means of a wood or metal screed, used perpendicular to the forms, to obtain required grade and remove surplus water laitance. Broom finish the surfaces and finish edges with an edging tool having a radius of 1/2 inch.
- 3.11 Remove all curb and gutter forms within 24 hours after concrete is in place, and fill minor defects with mortar composed of one part portland cement and two parts fine aggregate. Plastering is not permitted. Finish all curbs and gutter surfaces while the cement is still green to a brush finish. For any surface areas that are too rough or where surface defects make additional finishing necessary, the curb shall be rubbed to a smooth surface with a soft brick or wood block, with water used liberally.

- 3.12 Surface Requirements: Test the gutters with a 20 foot straight edge laid parallel to the centerline of the roadway while the concrete is still plastic. Straight edging shall be done along the edge of the gutter adjacent to the pavement or along other lines on the gutter cross-section. Irregularities in excess of 1/4 inch shall be corrected immediately. Surface variations on sidewalks and driveways shall not exceed 1/4 inch under a 10 foot straight edge, nor more than 1/8 inch on a 5 foot traverse section.
- 3.13 Curing: Concrete shall be cured by the Membrane Curing Compound Method for a continuous period of 72 hours minimum, commencing after completing the finishing and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Immediately replace any curing material that may be removed or damaged during the 72-hour period.
- This method requires the application of a clean membrane curing compound or white pigmented curing compound as in the Membrane Curing Compound paragraph above, by a hand sprayer in a single continuous film with uniform coverage of at least one gallon to each 200 square feet. Any cracks, check or other defects shall be recoated immediately. Agitate the curing compound thoroughly in the drum prior to application, and during application as necessary to prevent settlement of the pigment.
- 3.14 Backfilling and Compaction: After the concrete has set sufficiently, but no later than 3 days after the pouring, the spaces in front and back of the curb and other excavation generated from this work shall be refilled to the required elevation with suitable material, placed and thoroughly compacted in layers not to exceed 6 inches.
- 3.15 Protection: The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required.
- 3.16 Testing: Provide not less than three 6 inches by 12 inches cylinder compressive strength tests (ASTM C 39) and one slump test (ASTM C 143) for each 75 cubic yards of part thereof poured.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of storm sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 section "EARTHWORK/UNDERGROUND UTILITIES" for excavation and backfill required for storm sewage systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of storm sewage system's products of types, materials, 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 storm sewage work similar to that required for project.
- C. Codes and Standards:
1. Plumbing Code Compliance: Comply with applicable portions of Florida Department of Transportation Standard Specification, 1988 Edition, pertaining to selection and installation of storm sewage system's materials and products.
- D. Environmental Compliance: Comply with applicable portions of applicable Water Management District and Local Stormwater Management Codes pertaining to storm sewage systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for storm sewage system materials and products.
- B. Shop Drawings: Submit shop drawings for storm sewage systems, showing piping materials, size, locations, and inverts. Include details of underground structures, connections, and manholes. Show interface and spatial relationship between piping and proximate structures.
- C. Record Drawings: At project closeout, submit record drawings of installed storm

sewage piping and products, in accordance with requirements of Division-1.

- D. Maintenance Data: Submit maintenance data and parts lists for storm sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1.

PART 2 - PRODUCTS

2.1 PIPES AND PIPE FITTINGS

- A. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
1. Cast-Iron Soil Pipe: ASTM A 74, hub and spigot ends, service weight unless otherwise indicated.
 - a. Fittings: Cast-iron hub and spigot complying with ASTM A 74; lead/oakum caulked joints, or compression joints with rubber gaskets complying with ASTM C 564.
 2. Reinforced Concrete Pipe: FDOT 941, Class III (of ASTM C76).
 - a. Fittings: Reinforced concrete, same strength as adjoining pipe, tongue-and-groove gasketed joints complying with ASTM C 443.
 - b. Rubber Gaskets: FDOT 942.
 3. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35.
 - a. Fittings: PVC, ASTM D 3033 or D 3034, elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.
 4. Corrugated Steel Pipe and Pipe Arch: FDOT 943, bituminous coated both sides.
 5. Corrugated Steel Pipe and Pipe Arch: Aluminum coated (Aluminized Type II): AASHTO M274 and AASHTO M36.
 6. Coupling/Corrugated Steel Pipe and Pipe Arch: AASHTO M36 with rubber or neoprene gaskets, FDOT 430-8.1 (all pipe).
 7. Corrugated Aluminum Pipe and Pipe Arch: AASHTO M196 and AASHTO M211.
 8. Corrugated Aluminum Pipe with Perforations (360 degree): AASHTO M196 and M211, ASTM B 209 for Alloy Alclade 3004-H34.
 9. Coupling/Corrugated Aluminum Pipe and Pipe Arch: AASHTO M196 and AASHTO M211 with asphaltic mastic sealant (performed plastic material), (all pipe).
 10. Filter Fabric: Spun bound polypropylene, "TYPAR," as manufactured by DuPont, Style 3401.
 11. Bituminous Coating: AASHTO M190.
 12. Non-shrinking Mortar: Embeco 167 or approved equal.
 13. Precast Circular Manholes: Precast reinforced concrete per ASTM C 487, except wall thickness shall be 1 inch per foot of inside diameter plus 1 inch but 5 inch minimum. All openings shall have minimum steel hoop of #4 wire. Cement shall be Portland

- Type II. Provide a 6-inch lip on the base.
14. Concrete: FDOT 345-2 (except no pozzolon), 4, 6, 9, 10, 11, 12 and 13. Class II or Class III with minimum 28 day compressive strengths of 3400 psi and 5000 psi, respectively. Use Type II Portland Cement.
 15. Reinforcement: FDOT 415 (ASTM A615, Grade 60).
 16. Curing: FDOT 925.
 17. Brick: ASTM C 32, grade MC (hard brick).
 18. Mortar: For brick sections of manholes mix one (1) part Portland Cement Type II and three (3) parts of sand per FDOT 902-2.2. For mortar plaster use one (1) part cement, two (2) parts sand.
 19. Manhole Joint Sealer: Pre-formed plastic joint sealer per Federal Specification SS-S-00210 (GSA - PSS), "Ram-Nek" as manufactured by the K.T. Snyder Co., Inc., or approved equal, or Portland Cement mortar, 1/2 inch minimum thickness.
 20. Manhole Frame & Cover: Gray cast iron per ASTM A 48, Class 30 without perforations and suitable for addition of cast iron or steel rings for upward adjustment of top. The word "STORM" shall be cast into the face of the cover equal to that shown in the Standard Detail Drawings in 1-1/2 to 2 inch letters raised flush with the top of the cover. Frame and cover shall be approved equal to U.S. Foundry and Manufacturing Corp. No. 430 (old No. 32 with Type G cover). Frames and covers shall have machine ground seats and have a coating of coal tar pitch varnish.
Where prefabricated adjustable frames are called for in the Drawings, they shall be approved equal to U.S. Foundry No 560 (old No. 23 with Type G Cover) and comply with the above requirements.
 21. Inlet Gratings and Frames: Structural steel, FDOT 425-3.2, U.S. Foundry or equal; Gray Cast Iron, FDOT 962-8.
 22. Bitumastic: Koppers No. 300M, or approved equal.
 23. Non-shrink Mortar: Embeco 167 or approved equal.
 24. Forms: Forms shall be either wood or metal, externally secured and braced when feasible, substantial and unyielding, and of adequate strength to contain the concrete and the additional force of vibration consolidation without bulging between supports and without apparent deviation from neat lines, contours and shapes shown in the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. General: Trench excavation and backfill, including sheeting and bracing dewatering, foundation and bedding and furnishing and disposal of materials shall be as specified in Section 02210 of these Standard Specifications, "EARTHWORK- UNDERGROUND UTILITIES" with any additional requirements included herein.
- B. Laying Pipe: Pipe shall be laid "in the dry" true to the lines and grades given with hubs

upgrade and tongue fully inserted into the hub. Provide recesses at each joint as required to establish continuous loading conditions along the pipe barrel. Maintain a clean interior as the work progresses. Adequate filtering methods shall be provided to prevent flushing debris and sediment into any receiving waters.

- C. Round Concrete Pipe: ASTM C443-85a. Seal all joints with round rubber gaskets. The gasket and the surface of the joints must be clean and free of grit, dirt and other foreign matter. To facilitate closure of the joint, apply a vegetable soap lubricant immediately prior to closing. Do not apply mortar, joint compound, or other filler which will restrict the flexibility of the gasket joint.

Deviations from true alignment or grade, which result in a displacement from the normal position of the gasket of as much as 1/4 inch, or which produce a gap exceeding 1/2 inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe, will not be acceptable and where such occur the pipe shall be re-laid without additional compensation. Where minor imperfections cause a gap greater than 1/2 inch between pipe sections, the joint will be acceptable provided the gap does not extend more than 1/3 the circumference of the inside of the pipe.

- D. Oval Concrete Pipe: Seal all joints with round rubber gaskets. The gasket and the surface of the joints must be clean and free of grit, dirt and other foreign matter. To facilitate closure of the joint, apply a vegetable soap lubricant immediately prior to closing. Do not apply mortar, joint compound, or other filler which will restrict the flexibility of the gasket joint.
- E. Corrugated Steel Pipe: Field joint corrugated steel pipe with locking steel bituminous coated bands and rubber or neoprene gaskets to secure a water-tight joint. The gaskets shall be at least 7 inches in width and at least 3/8 inches thick, or O-ring gaskets with a minimum chord diameter of 13/16 inch, with annular ends. A vegetable soap lubricant is acceptable to facilitate the field connection. A minimum of 10-1/2 inch bandwidth shall be provided.
- F. Corrugated Aluminum Pipe: Make field joints with aluminum bands and asphaltic mastic gasket to secure a watertight joint. Band width shall be a minimum of 7 inches for 6 - 30 inch diameter and 12 inches for 36 - 60 inch diameter pipes.
- G. Cast-Iron Soil Pipe: Install in accordance with applicable provisions of CISPI "Cast Iron Soil Pipe & Fittings Handbook."
- H. Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.
- I. Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.

3. Flush lines between manholes if required to remove collected debris.
- J. Joint Adapters: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.
- K. Closing Abandoned Utilities: Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.
 1. Close open ends of concrete or masonry utilities with not less than 8 inches thick brick masonry bulkheads.
- L. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
 1. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2 feet of backfill is in place, and again at completion of project.
 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and reinspect.

3.2 STORM SEWER STRUCTURES

- A. Fabrication: All structures shall be constructed as shown in the Drawings or Standard Detail Indexes per FDOT Roadway and Bridge Design Standards. Structures may be precast concrete or poured in place concrete.
- B. Foundation: Compact the soil beneath the structure to 95 percent of maximum (AASHTO T-180) density. Additionally provide 9 inches of gravel beneath structures with precast bases.
- C. Manhole Base: Construct per Standard Detail Drawings with Type II Portland Cement concrete, Class II or cast as an integral part of the precast section. If the base is poured, form a groove in the base with an accurate manhole ring, shape with a wood float and finish with a hard steel trowel prior to setting. The base shall set a minimum of 24 hours before the manhole construction proceeds. Precast base shall have a minimum of three lifting hooks set in. The base shall extend 6 inches on all sides of the structure.
- D. Joints - Precast Structures: Structures without precast integral bottoms shall be set in a bed of mortar to make a watertight joint at the base. Join precast sections with a minimum mortar thickness of 1/2 inch, maximum of 1 inch. Joint sealer may be used as an alternate.
- E. Poured-in-place Concrete Structures: Concrete shall not be placed in any form until the reinforcing steel has been inspected and approved. Place concrete as noted in the Drawings and vibrate thoroughly. Fill each part of the forms, work the course aggregate back from the face and force the concrete under and around the reinforcing

bars without displacing them from proper position. Place the concrete in approximately 12 inch lifts so as not to induce separation or segregation of the aggregates, consolidate thoroughly before proceeding onward continuously so that there will be no plain separation between layers. Provide construction joints in accordance with the Drawings. Rub all exposed surfaces smooth to a point 12 inches below the proposed finished grade. All slabs open to traffic will be broom finished.

- F. Curing: Cure continuously for a period of at least 72 hours, to commence after the finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Curing may be accomplished by means of polyethylene covering, membrane curing compound, or wet-burlap. These methods shall initiate after the forms are removed and as outlined below:
1. Burlap. Place burlap over the entire surface of the concrete with overlap of approximately 6 inches along each edge and in contact with the entire surface.
 2. Membrane Curing Compound. Apply membrane compound (clear or white) in one continuous uniform coating at a rate of one gallon per 200 square feet of area. Immediately recoat any crack or other defects appearing in the coating. Agitate the compound prior to application as well as during to prevent settlement of the pigment.
 3. Polyethylene Sheeting. Place polyethylene sheeting over the entire surface with sufficient overlap of approximately 6 inches along the sides. Sheeting should be in continuous contact with the concrete at all times.
- G. Manhole Invert: shape invert channels to a trowel finish conforming to the sizes and shapes of the lower 0.8 diameter of the inlets and outlets called for in the Drawings. changes in direction of the sewer and entering branch or branches shall have a true curve, with a centerline radius of at least three times the pipe diameter or channel width. Straight-through channels may be formed with pre-cut half pipes.
- H. Manhole Coating: Coat the exterior surface with one coat of bitumastic at a minimum rate of 375 square feet per gallon, factory applied and "touched-up" in the field.
- I. Manhole Frames and Covers: Set manhole frames and covers to conform to the grades in the Drawings. Set all frames securely in a cement mortar bed and fillet. All covers shall be made flush with existing permanent surfaces except outside the limits of the traveled ways where they should be set approximately 0.2 foot above the existing ground unless otherwise noted in the Drawings.
- J. Manholes Watertightness: When tested by plugging all inlets and the outlet and filling the structure to within one foot of the cone section or top, with a minimum depth of 4 feet and maximum depth of 20 feet, the maximum allowable drop of the water surface shall be 1/2 inch per 15 minute interval. Contractor shall plug all leaks by method approved by the Engineer.
- K. Pipe Connections: Seal pipes into structure openings with non-shrinking mortar. Provide one joint immediately outside the structure wall. Openings into existing structures shall be cut with a power driven abrasive wheel or saw.

3.3 BACKFILLING

- A. General: Conduct backfill operations of open cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.

3.4 FIELD QUALITY CONTROL

- A. Lamping: Lamp all sewers between manholes, and catch basins after the backfill has been compacted to determine that they are clear of debris and to the correct alignment. The concentricity of the lamp image received shall not vary in the vertical direction but may vary up to 20 percent in the horizontal direction.
- B. Inspection: Final visual inspection shall be made after all structures are raised to finished grade and the roadway installed. If the lines are unclean, clean-up and re-lamping shall be initiated. Contractor shall assist the engineer during this inspection.

END OF SECTION

SECTION 02831 - CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of chain link fences and gates is indicated on drawings.

1.3 QUALITY ASSURANCE

- A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Galvanized Steel Fencing and Fabric:
 - a. Allied Tube and Conduit Corp.
 - b. American Fence Corp.
 - c. Anchor Fence, Inc.
 - 2. Aluminized Steel Fencing and Fabric:
 - a. Page Fence Div./Page-Wilson Corp.
 - b. Cyclone Fence/United States Steel Corp.
 - c. or approved equal

3. Aluminum Fencing and Fabric:
 - a. Chain Link Fence Company of Pennsylvania.
 - b. Security Fabricators, Inc.
 - c. or approved equal
4. Barbed Type:
 - a. American Fence Corp.
 - b. Man Barrier Corp.

2.2 STEEL FABRIC

- A. Fabric: No. 9 ga. Core wire (0.148" + 0.005") size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high. Vinyl Coating shall be class 2b thermally fused & bonded per ASTM 668.
 1. Furnish one-piece fabric widths for fencing up to 12' high.
 2. Fabric Finish: Galvanized, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
 3. Fabric Finish: Aluminized, ASTM A 491, Class II, with not less than 0.40 oz. aluminum per sq. ft. of surface.

2.3 FRAMING AND ACCESSORIES

- A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.
 1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.
- B. End, Corner and Pull Posts: Minimum sizes and weights as follows:
 1. Up to 6' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft., 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
 2. Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
- C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.
 1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625"

C-sections, 2.28 lbs. per lin. ft.

2. 6' to 8' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64 lbs. per lin. ft.
3. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.

D. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Leaf Width	Gate Post	lbs./lin. ft.
Up to 6'	3.5" x 3.5" roll-formed section or 2.875" OD pipe	4.85
Over 6' to 13'	4.000" OD pipe	5.79
Over 13' to 18'	6.625" OD pipe	9.11
Over 18'	8.625" OD pipe	18.97
		28.55

E. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1. 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

F. Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

1. Locate at bottom of fabric.

G. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.

H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

I. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

J. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

- K. Stretcher Bars Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.
- L. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms, metal and finish to match fence framework, with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lbs. downward pull at outermost end. Provide following type:
1. Single 45 deg. arm; for 3 strands barbed wire, one for each post.
- M. Barbed Wire: 2 strand, 12-1/2 ga. wire with 14 ga. 4-point barbs spaced not more than 5" o.c., metal and finish to match fabric.
- N. Barbed Tape: Continuous helical coils of barbed stainless steel tape, fabricated from .025" thick x 1" wide austenitic stainless steel with 4 needle sharp barbs on 4" centers and permanently clenched to .098" diameter core wire of high tensile zinc-coated steel. Adjacent loops clipped together to limit extension of coil. Provide coil diameter, type and configuration as indicated; if not otherwise indicated, provide 24" diameter, single concertina type coil.

2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to gate frame at not more than 15" o.c.
 2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
 3. Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above to member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.
- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM

A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 deg. gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
- D. Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undistributed or compacted soil.
1. If not indicated on drawings, excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
 2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2" above grade and

trowel to a crown to shed water.

- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- H. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- J. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.
- K. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and securely fasten to fencing to prevent movement or displacement.
- L. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- M. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
 - 1. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence

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opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION

SECTION 16050 (26 05 00) - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
 - 6. Commissioning requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 GENERAL REQUIREMENTS

- A. Carefully examine General Conditions, other specification sections, and other drawings (in addition to DIVISION 26), in order to be fully acquainted with their effect on electrical work. Additions to the contract cost will not be allowed due to failure to inspect existing conditions.
- B. Do all work in compliance with 5th Edition Florida Building Code 2014, and the Codes adopted therein, including NFPA 70 (2011 NEC), 5th Edition Florida Fire Prevention Code and the regulations of the local power utility, cable television and telephone companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like, and deliver such certificates to the Architect/Engineer.
- C. Cooperate and coordinate with all other trades. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the condition of the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
- D. Furnish, perform, or otherwise provide all labor (including, but not limited to, all planning, purchasing, transporting, rigging, hoisting, storing, installing, testing, chasing, channeling,

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COMMON WORK RESULTS FOR ELECTRICAL

cutting, trenching, excavating and backfilling), coordination, field verification, equipment installation, support, and safety, supplies, and materials necessary for the correct installation of complete and functional electrical systems (as described or implied by these specifications and the applicable drawings).

- E. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required.
- F. Circuiting and connection of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Secure rough-in drawings and connection information for equipment involved to determine the exact requirements. See all divisions of drawings or specifications for electrically operated equipment. If the connection of an item is not shown on the electrical drawings and it is unclear how to provide for the circuiting and connection, notify the engineer of record in writing prior to bidding project. Submission of a bid indicates that the bidder has included these requirements as part of the scope of work.

1.5 DRAWINGS:

- A. Indicate only diagrammatically the extent, general character, and approximate location of work. Where work is indicated, but with minor details omitted, furnish and install it complete and so as to perform its intended functions.
- B. DIVISION 26 work called for under any section of the project specifications, shall be considered as included in this work unless specifically excluded by inclusion in some other branch of the work. This shall include roughing-in for connections and equipment as called for or inferred. Check all drawings and specifications for the project and shall be responsible for the installation of all DIVISION 26 work.
- C. Take finish dimensions at the job site in preference to scale dimensions. Do not scale drawings where specific details and dimensions for DIVISION 26 work are not shown on the drawings, take measurements and make layouts as required for the proper installation of the work and coordination with all drawings and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications that have not been clarified by addendum prior to bidding, it shall be assumed by the signing of the contract that the higher cost (if any difference in costs) is included in the contract price, and perform the work in accordance with the drawings or with the specifications, as determined and approved by the Architect/ Engineer, and no additional costs shall be allowed to the base contract price.
- D. Carefully check the drawings and specifications of all trades and divisions before installing any of his work. He shall in all cases consider the work of all other trades, and shall coordinate his work with them so that the best arrangements of all equipment, piping, conduit, ducts, rough-in, etc., can be obtained.
- E. Review the specific equipment (such as mechanical, plumbing, kitchen, FFE, etc) minimum circuit ampacity and maximum over current protection requirements of equipment provided by others to confirm it is properly coordinated with the devices being purchased. Notify the AE team immediately upon discovery of discrepancies. This shall be done at the submittal stage prior to purchasing over current protection or installation of conduit, wire, disconnects, breakers, etc. No cost will be allowed for changes to coordinate.

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- F. Locations designated for outlets, switches, equipment, etc., are approximate and shall be verified by instruction in these specifications and/or notes on the drawings. Where instructions or notes are insufficient to convey the intent of the design, consult the Architect/Engineer prior to installation.
- G. Obtain manufacturer's data on all equipment, the dimensions of which may affect electrical work. Use this data to coordinate proper service characteristics, entry locations, etc., and to ensure minimum clearances are maintained.

1.6 QUALIFICATIONS OF CONTRACTOR:

- A. DIVISION 26 Contractor shall have had experience of at least the same size and scope as this project, on at least two other projects within the last five years in order to be qualified to bid this project.
- B. Contractor performing any part of this scope of work shall be a State Certified (Type E.C. License) electrical contractor
- C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have an active Journeyman's Electrical License.

1.7 SITE VISIT/CONDITIONS

- A. Visit the site of this contract and thoroughly familiarize with all existing field conditions and the proposed work as described or implied by the contract documents. During the course of his site visit, verify every aspect of the proposed work and the existing field conditions in the areas of construction which might affect his work. No compensation or reimbursement for additional expenses incurred due to failure or neglect to make a thorough investigation of the contract documents and the existing site conditions will be permitted.
- B. Install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Coordinate the proper arrangement and installation of all equipment within any designated space. If it is determined that a departure from the Contract Documents is necessary, submit to the A/E, for approval, detailed drawings of the proposed changes with written reasons for the changes. No changes shall be implemented without the issuance of the required drawings, clarifications, and/or change orders.
- C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.
- D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.

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- E. All existing electrical is not shown. Become familiar with all existing conditions prior to bidding, and include in the bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to it's originating point.
- F. Locate all existing utilities and protect them from damage. Pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations. Verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.
- H. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner 72 hours in advance of any shut-down of existing systems. Perform work during non-operational hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.

1.8 COMMISSIONING RESPONSIBILITIES

- A. Attend commissioning meetings scheduled by the CM.
- B. Schedule work so that required electrical installations are completed, and system verification checks and functional performance test can be carried out on schedule.
- C. Inspect, check and confirm in writing the proper installation and performance of all electrical services as required by the system verification and functional performance testing requirements of electrical equipment in the commissioning specifications.
- D. Provide qualified personnel to assist and operate electrical system during system verification checks and functional performance testing of HVAC systems as required by the commissioning specifications.
- E. Provide instruction and demonstrations for the Owner's designated operating staff in accordance with the requirements of the commissioning specifications.

1.9 TEMPORARY POWER:

- A. Provide temporary power distribution for the connection of all single phase 120V 20A tools, OSHA work lighting, and testing as required for performance of the project. Provide OSHA required work lighting and task lighting for the project.
- B. Coordinate requirements with the local Utility Company for availability of adequate power. Include all cost associated with any Utility Company charges for connection or upgrades in this bid price.
- C. If power to any of the existing facilities will be interrupted, coordinate the outage with the Owner atleast 72 hours in advance. All power outages will occur outside operational hours as determined by the Owner.

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COMMON WORK RESULTS FOR ELECTRICAL

- D. Provide temporary power to any buildings, parking lot lighting, canopy lighting, lift stations, etc that will have power removed during the course of construction temporarily. Additionally, if any new buildings, parking lots, lift stations, etc will need power until the permanent power becomes available, provide temporary power until the permanent power is available.
- E. Provide temporary lighting for all areas that will require lighting for Owner's use as well as construction use during the course of construction. Temporary lighting must comply with all FBC requirements as though it was being installed for permanent use. This includes but is not limited to any temporary canopies, parking lots, walkways or roads. If you are unsure of how to connect or provide this lighting, notify the engineer of record in writing prior to bidding project. Submission of a bid indicates that the bidder has included these requirements as part of the scope of work.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Engineer shall have no responsibility for job site safety and the Contractor shall have full and sole authority for all safety programs and precautions in connection with the Work. Nothing herein shall be interpreted to confer upon the Engineer any duty regarding safety or the prevention of accidents at the jobsite.
- B. Comply with NECA 1.
- C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- F. Right of Way: Give to piping systems installed at a required slope.
- G. All work shall be executed in a workmanship manner and shall present a neat mechanical appearance upon completion.
- H. Care shall be exercised that all items are plumb, straight, level.
- I. Care shall be exercised so that Code clearance is allowed for all panels, controls. etc., requiring it. Do not allow other trades to infringe on this clearance.

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COMMON WORK RESULTS FOR ELECTRICAL

- J. Balance load as equally as practicable on all feeders, circuits and panel buses.
- K. The electrical circuits, components and controls for all equipment are selected and sized based on the equipment specified. If substitutions are proposed, furnish all materials and data required to prove equivalence. No additional charges shall be allowed if additional materials, labor, connections or equipment are needed for substituted products.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Coordinate with roofing scope of work for the installation of electrical items which pierce roof. Roof penetrations shall not void warranty. Pitch pockets are not acceptable.
- D. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types.
- E. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors **2 inches** above finished floor level.
- I. Size pipe sleeves to provide **1/4-inch** annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry
- K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- L. Fire-Rated-Assembly Penetrations: Firestop penetrations of walls, partitions, ceilings, and floors under Division 07 Section "Firestopping."
- M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work. The use of pitch pockets is not acceptable.

3.3 CONCRETE PADS

- A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by three (3) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment.
- B. Provide concrete pad for exterior pad mount transformers as required by power company.
- C. Provide concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

3.4 DEMOLITION

- A. Unless otherwise specified, all equipment and materials shall remain the property of the Owner. Owner shall have first rights to all demolished items if they decide it is usable. This selected property of Owner shall be delivered to a location where directed by Owner within 15 miles of site and all other items shall be removed from the job site and legally disposed of by the Contractor.
- B. Cut no structural members without written approval from the structural engineer of record and Owner.

3.5 MISCELLANEOUS CIRCUITS REQUIRED

- A. Provide 120 volt, 20 amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer of Record of required circuit so that final circuit information may be provided to the contractor. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- B. Provide 120 volt, 20 amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer of Record of required circuit so that final circuit information may be added to the drawings. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- C. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer of Record of required circuit so that final circuit information may be added to the drawings. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid

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and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

- D. Provide 120 volt, 20 amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer (whether shown on drawings or not) Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- E. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer of Record of required circuit so that final circuit information may be added to the drawings. Re-label circuit breaker accordingly. Coordinate location with drawings or specifications prior to bid and provide all electrical.
- F. Provide circuitry for interactive flat panel display system to coordinate the Presentation Stations and flat panel display system to be on the same circuit or circuit phase (whether shown as such on drawings or not). Notify Engineer of Record of required circuit so that final circuit information may be coordinated on the drawings if not indicated correctly. Re-label circuit breakers accordingly.
- G. Provide 120V 20A circuits and receptacles for digital message boards in Kitchens. Verify exact locations with Food Nutritional Services (whether shown on drawings or not). Notify Engineer of Record of required circuit so that final circuit information may be added to the drawings. Re-label circuit breakers accordingly.
- H. Provide 120 volt, 20 amp circuit to door hardware power supplies (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Notify Engineer (if not shown on drawings) Coordinate location with door hardware requirements prior to bid and provide all electrical.

END OF SECTION 16050

SECTION 16060 (26 05 26) - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems, equipment and common ground bonding with lightning protection system.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Comply with UL 467 for grounding and bonding materials and equipment.
- B. Test all ground rod locations as described to confirm quality standard intent is attained.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Lugs: Compression of substantial construction, cast copper or cast bronze, with "ground" (micro-flat) surfaces, compression type, two-hole tongue, equal to Burndy or equal by T&B or OZ Gedney. Lightweight and "competitive" devices shall be rejected.
- E. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
- F. Grounding Screw and Pigtail: Raco No. 983 or equal.
- G. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp or equal.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 5/8 inch by 10 feet in diameter.

2.4 GROUNDING WELL COMPONENTS

- A. All Areas:
 - 1. Well: Minimum 12 inch long by 12 inch wide by 18 inches deep with open bottom.
 - 2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
 - 3. Material: Composolite.
 - 4. Manufacturer: Quazite.
 - 5. Increase depth, diameter or size as required to provide proper access at installed location.

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

2.5 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

- A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 4" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
- B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy or T&B.
- C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

PART 3 - EXECUTION

3.1 GROUNDING ELECTRODES

- A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.
- B. Each rod shall be die stamped with identification of manufacturer and rod length.
- C. Install rod electrodes at locations indicated and/or as called for in these specifications.
- D. Ground Resistance:
 - 1. Main Electrical Service (to each building) and Generator Locations:
 - a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
 - 2. Other Locations:
 - a. Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - 3. Lightning Protection system ground locations shall not exceed 5 ohms for the Franklin system measured at ground electrode.
 - 4. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two (2) or more ground rod electrodes then the resistance specified

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

above shall be the maximum resistance with two (2) or more rods connected together but not connected to the grounding electrode conductor.

- E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80 feet or more in length.
- F. Verify that final backfill and compaction has been completed before driving rod electrodes.
- G. Install ground rods not less than 1 foot below grade level and not less than 2 feet from structure foundation.

3.2 EQUIPMENT GROUNDING CONDUCTOR

- A. Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- B. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- C. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- D. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.3 MAIN ELECTRICAL SERVICE

- A. Existing Buildings:
 - 1. Verify that each building's electrical service is properly grounded as required by the NEC.
 - 2. Provide and install electrical service grounding at each building as called for herein for all existing services that do not comply with the grounding specified above.
 - 3. Supplement existing electrical service grounding at each building as required to comply with all requirements in these specifications.
 - 4. If exterior ground rod electrode does not exist at each buildings main electrical service, provide and install these ground rods as called for main electrical service, exterior of building. Connect all counterpoise conductors required elsewhere thereto.

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- B. Ground electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.
- C. Bond to all of the following when available on site:
 - 1. Ground Rods
 - 2. Metal Water Pipe (Interior and Exterior to Building)
 - 3. Building Metal Frame, Structural Steel and/or Reinforced Structural Concrete
 - 4. All Piping Entering or Leaving All Buildings (Including Chilled Water Piping)
 - 5. Encasing Electrodes
 - 6. Ground Ring
 - 7. Site Distribution Counterpoise Ground System
 - 8. Lightning Protection System
- D. A main ground, bare copper conductor, sized per applicable table in NEC, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:
 - 1. Three 30 ft. ground rods in a delta configuration at no less than 30 ft. spacing driven to a minimum depth of 30 ft. plus 1 below grade.
 - 2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.
 - 3. Provide additional rod electrodes as required to achieve specified ground resistance.
- E. Ground/bond neutral per NEC.
- F. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.
- G. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC.

3.4 TRANSFORMER GROUNDING

- A. Ground all transformers and enclosures of 120/208V and 277/480V "separately derived systems" as specified herein.
 - 1. Ground per NEC 250 and these specifications.
 - 2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC.
 - 3. Connect transformer neutral/ground to grounding electrode per NEC with grounding electrode conductor sized per applicable table in NEC.
 - 4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC) provide, install and connect supplemental grounding electrode as follows:

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- a. Where grounding required per NEC is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
 - b. Where grounding connection required per NEC is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC.
 - c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 6. Where transformer is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 5. above. This ground rod electrode shall also be connected to counterpoise system (wherever counterpoise system is available).
 7. Ground to water system service pipe as required by NEC.
- B. Provide additional ground electrodes as required to achieve specified ground resistance.
- C. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC, but in no case less than #2/0.
- D. Provide and install ground bus bar on wall near transformer (or in associated electrical room for exterior mounted transformers). Connect to ground lug in transformer bonded to transformer enclosure/neutral with copper ground conductor sized per applicable table in NEC.

3.5 GENERATOR GROUNDING

- A. Separately derived systems (i.e. systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4 pole switched neutral transfer switch systems).
1. Ground per NEC and these specifications.
 2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC.
 3. Connect generator neutral/ground to grounding electrodes per NEC with grounding electrode conductor sized per applicable table in NEC.
 4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC) provide, install and connect supplemental grounding electrode as follows:
 - a. Where grounding required per NEC is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
 - b. Where grounding connection required per NEC is to grounded metal water pipe, supplement this grounding with connection with connection to other electrodes specified in NEC.

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- c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 6. Where generator is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 5. above. This ground rod electrode shall also be connected to counterpoise system.
- B. Non separately derived systems (i.e. systems where generator neutral is solidly interconnected to service supplied system neutral such as 3 pole non-switched neutral transfer switch systems).
1. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.
 2. Connect generator frame/enclosures ground to grounding electrode per NEC with grounding electrode conductor sized per applicable table in NEC .
 3. In addition to connection to grounding electrode conductor called for above (i.e. per NEC) provide, install and connect supplemental grounding electrode as follows:
 - a. Where grounding required per NEC is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
 - b. Where grounding connection required per NEC is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC.
 - c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 4. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 5. Where generator is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 5. above. This ground rod electrode shall also be connected to counterpoise system.
- C. Provide additional ground electrodes as required to achieve specified ground resistance.
- D. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC, but in no case less than #2/0.

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3.6 LIGHTNING PROTECTION SYSTEMS

- A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.
- B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.
- C. Lightning protection ground rods shall be 20' in length and should not be driven deeper. If additional rods are required to achieve the required resistance to ground, they should be added in parallel with the first at one rod length separation.

3.7 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT

- A. General:
 - 1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
 - 2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
- B. Main electrical service rack mounted equipment.
 - 1. Ground per "MAIN ELECTRICAL SERVICE".
 - 2. Bond all metal parts as noted above.
- C. Electrical sub service rack mounted equipment.
 - 1. Ground per "MAIN ELECTRICAL SERVICE", except do not bond neutral to ground.
 - 2. Bond all metal parts as noted above.
- D. Electrical equipment connection rack mounted equipment.
 - 1. Bond all metal parts as noted above.
- E. Grounding electrodes (ground electrodes system) shall be:
 - 1. Located at each rack location.
 - 2. For service equipment: Ground electrode required per "MAIN ELECTRICAL SERVICE".
 - 3. For equipment connection equipment: Two or more 30 ft. ground rods at no less than 30 ft. spacing, driven vertical to a minimum depth of 1 ft below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC , but no less than a #2

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copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.

3.8 LIGHTING FIXTURES

- A. All new and removed/reinstalled fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
- B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.
- C. Pole Light Fixtures:
 - 1. Metal Pole Light Fixtures:
 - a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
 - b. Conductor shall be bonded to metal pole via UL Listed ground clamp suitable for use. Locate ground lug opposite to handhole (or adjacent if visible through handhole).
 - 2. Concrete or Non-Metallic Pole:
 - a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
 - b. Conductor shall be extended from grounding electrode to top of pole and terminate at the top of pole in a Class I or Class II copper lightning protection air terminal.
 - c. Each metal part of light fixture assembly, bracket, ballast cabinet, disconnect, transformer, etc. that is mounted to pole shall be bonded to down conductor.
 - 3. Fixtures located on elevated roadway ramps shall be specially provided with a connection to lightning counterpoise grounding system, properly installed.
 - 4. Grounding electrode(s) at each pole shall be connected (bonded) to site distribution counterpoise system.
 - 5. Grounding Electrodes:
 - a. Two or more 10 ft. ground rods at no less than 10 ft. spacing shall be driven vertically to a minimum depth of 10 ft. plus 1 below grade.
 - b. Bond the two or more ground rod electrodes together with a Class I or Class II lightning protection main copper conductor.
 - c. Provide additional rod electrodes as required to achieve specified ground resistance.
 - d. The two (2) or more grounding rod electrodes shall be installed at each light pole.

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

6. Installation shall exceed minimum requirements of NFPA 780.

3.9 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

- A. One 30 ft. ground rod electrode shall be driven vertically to a minimum depth of 30 ft. plus 1 ft. below grade in each manhole, handhole or pullbox (in ground).
- B. Bond to counterpoise system (whenever counterpoise system is provided.)
- C. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pullbox (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3 ft. or more slack ground cable on cover connection as required to facilitate removal of cover.

3.10 GROUND RING

- A. Provide complete underground building perimeter ground ring system, completely encircling each building.
- B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).
- C. Install at not less than 2-1/2 feet depth into earth.
- D. Install ground rods 20 ft. long every 150 feet section of ground ring conductor.
- E. Bond ground ring to building steel every 150 feet of building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.
- F. Bond to building service and counterpoise ground systems.

3.11 MISCELLANEOUS GROUNDING CONNECTIONS

- A. Provide bonding to meet regulatory requirements.
- B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will not affect the structural properties of the steel. Required connections to existing building structural steel purlins/l beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.
- C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current

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carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

- D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
- E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.
- K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.
- L. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) full length rebars which contact the connected rebar .

3.12 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

- A. Where indicated on the drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge

SECTION 16060
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protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

- B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.
- C. Mount bus bar to wall using 2" polyester molded insulator stand-off.
- D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.
- E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Section 27 systems.
- F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800.
- G.

3.13 COMMUNICATIONS SYSTEMS

- A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems).
- B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.14 TESTING AND REPORTS

- A. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
- B. Upon completion of testing, the testing conditions and results shall be certified and submitted to the Architect/Engineer.

END OF SECTION 16060

SECTION 16120
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

SECTION 16120 (26 05 19) - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
 - 4. Metal Clad cable, Type MC

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Provide type and UL listing of each type of conductor, cable, connector and termination to be utilized for the DIVISION 26 scope of work.
- B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

SECTION 16120
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. BUILDING WIRES AND CABLES

1. CONDUCTOR INSULATION

- a. Comply with NEMA WC 70 for Types THHN-THWN
- b. Service Entrance: Type THHN-THWN CU or XHHW-2 Al, single conductors in raceway.
- c. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- d. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- e. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- f. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- g. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway or Metal-clad cable, Type MC (MC may only be utilized in certain specific installations as described elsewhere in this section).
- h. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway. Minimum #12.
- i. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway. Minimum #12.
- j. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- k. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- l. Class 2 Control Circuits: Type THHN-THWN, in raceway.

2. CONDUCTOR MATERIAL:

- a. Copper Conductors: Comply with NEMA WC 70.
- b. All #10 and smaller conductors shall be solid CU. No stranded conductors are permitted for #10 and smaller.
- c. Aluminum conductors may be used for 1/0 and larger panel board feeders if identified as aluminum on the electrical feeder schedule. Aluminum conductors shall be compact stranded aluminum alloy with XHHW-2 insulation, made of an AA-8000 series electrical grade aluminum alloy conductor material.

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2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. AMP Incorporated
 3. Anderson
 4. O-Z/Gedney; EGS Electrical Group LLC.
 5. 3M; Electrical Products Division.
 6. Burndy
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Aluminum connections shall be made with compression type wire barrels factory prefilled with oxide inhibiting compound. Set screw connectors are not acceptable.

2.3 FLEXIBLE METAL CLAD CABLE

- A. Comply with:
1. NFPA 70
 2. ANSI/UL 4/UL 83/UL 1479
 3. Fed. Specification J-C-30B
- B. Cable material:
1. Jacket material:
 - a. Galvanized Steel or aluminum , interlocked.
 2. Conductor covering: Paper wrap.
 3. Conductor Material:
 - a. Copper, Solid, THHN
 - b. Minimum #12 gauge
 - c. Maximum #10 gauge
 - d. 90 degree C, 600 volt.
 - e. Full size insulated grounding conductor, green.
 - f. Conductor color coding to match system voltage. Comply with Division 26 Section "Identification".
- C. Fittings:
1. ANSI/NEMA FB 1
 2. ANSI/UL 514B
 3. Zinc plated Malleable iron, or steel.
 - a. Direct flexible conduit bearing set screw type not acceptable.
 - b. Install insulated bushings or equivalent protection (i.e. Anti-short) between core conductors and outer jacket.

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PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES IN RACEWAY

- A. No cables shall be installed in raceways until the raceway system is complete from end to end.
- B. Examine raceways and building finishes to confirm compliance with contract requirements for installation tolerances and other conditions affecting installation of wires and cables. Do not proceed with installation until area is ready and any unsatisfactory conditions have been corrected.
- C. Verify that interior of building has been protected from weather.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. All branch circuit wire shall be sized for a maximum voltage drop of 3%. The contractor shall size all cables to comply with this requirement. Below are some guidelines that may be followed to achieve the correct voltage drop in lieu of providing custom calculations for each case.
 - 1. Use conductor not smaller than #12 AWG for all 120V 20A branch circuits less than 60' in length from the source breaker to any device.
 - 2. All 120V branch circuit conductors where the length is 61' to 120' from the source breaker to any device shall utilize #10 minimum throughout the circuit, unless otherwise noted.
 - 3. All 120V branch circuit conductors where the length is 121' to 240' from the source breaker to any device shall utilize # 8 minimum throughout the circuit, unless otherwise noted.
 - 4. All 120V branch circuit conductors where the length is greater than 241' from the source breaker to any device shall utilize # 6 minimum throughout the circuit, unless otherwise noted.
 - 5. Use conductor not smaller than #12 AWG for all 277V 20A branch circuits less than 140' in length from the source breaker to any device.
 - 6. All 277V branch circuit conductors where the length is 141' to 220' from the source breaker to any device shall utilize #10 minimum throughout the circuit, unless otherwise noted.
 - 7. All 277V branch circuit conductors where the length is 221' to 340' from the source breaker to any device shall utilize # 8 minimum throughout the circuit, unless otherwise noted.
 - 8. All 277V 20A branch circuit conductors where the length is greater than 341' from the source breaker to any device shall utilize # 6 minimum throughout the circuit, unless otherwise noted.
- H. Provide a dedicated neutral conductor for all dimmer circuits from the load back to the dimmer module or switch.

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- I. Provide a dedicated neutral conductor for all computer receptacle circuits from the load back to the branch circuit panel board.
- J. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- K. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.
- L. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).
- M. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

3.2 INSTALLATION REQUIREMENTS FOR METAL CLAD CABLES

- A. Metal Clad Cables may be used only as specified, where permitted by NEC, and if approved by the Local Inspecting Authority having Jurisdiction.
- B. MC Cable shall not be run to the panel board or electrical room. All final runs to the panelboard shall be in conduit to a point at least 10' outside the electrical room. No more than 6 current carrying conductors shall be run in any conduit to a junction box outside the electrical room. No junction box shall contain more than 6 current carrying conductors. Wireways are not permitted for the termination of MC cables.
- C. MC cable shall not be used for any other building system wiring (except power and lighting).
- D. MC cables shall not be used for switch legs.
- E. MC cables shall not be used for feeder circuits or for systems.
- F. Utilize the same sizing requirements for 20A branch circuit conductors as listed for conductors in raceways.
- G. Connectors and supporting components shall be UL Listed for such use. Tie wire is not acceptable for supporting MC cable.
- H. Cut cables with UL listed tools intended for such use. Ream smooth and free of sharp and abrasive areas. Install bushing between conductors and outer jacket. The use of slide cutters or dikes to cut cables is not acceptable.
- I. Maintain minimum 1/2 inch separation between each cable and support per NEC. The practice of bundling cables is not acceptable.
- J. Install cables minimum of 1'-0" from communications cables.
- K. Attachment of cables to ceiling system is prohibited.
- L. Attachment of cables to, on, or from mechanical (HVAC) equipment, supports, etc., is not permitted.

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- M. Install cables parallel and perpendicular to building structure.
- N. Zigzagging cables through building elements, as method of support is not acceptable.
- O. Cable with outer metal sheath damaged by construction elements and/or improper installation shall be replaced at no additional cost to owner.

3.3 CONNECTIONS

- A. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. All aluminum connections shall be made with approved compression connectors before being connected to lugs. Conductors shall be cleaned with a wire brush immediately prior to connecting.
- D. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- F. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).
- G. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.
- H. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. A calibrated torque wrench shall be used for all bolt tightening.
- J. All interior power and lighting taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire. Utilize weatherproof connectors for all splices in exterior boxes.
- K. No splices are permitted in exterior below grade handhole or pull boxes.

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3.4 FIELD QUALITY CONTROL

- A. After feeders are in place, but before being connected to devices and equipment, test for shorts, opens, and for intentional and unintentional grounds.
- B. Cables 600 volts or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 1000 V internal generating voltage. Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing same. If values are less than recommended NETA values notify Engineer. Submit five copies of tabulated megger test values for all cables.
- C. Cables 250 volts or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 500 V internal generating voltage. Readings shall be recorded and submitted to the Engineer, for acceptance prior to energizing same. Submit five copies of tabulated megger test values for all cables.
- D. Perform Insulation resistance test and turns ratio test. Submit five copies to engineer at substantial completion.
- E. Remove and replace malfunctioning units and retest as specified above.

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SECTION 16131 (26 05 33) - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. NBR: Acrylonitrile-butadiene rubber.
- H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.

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- d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
- 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit - Zinc Coated
- B. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated
- C. ANSI C80.5 - Aluminum Rigid Conduit (ARC)
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- E. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ANSI/NFPA 70 - National Electrical Code
- H. NECA Standard Practices for Good Workmanship in Electrical Contracting
- I. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Minimum Trade Size

1. All Conduit (except switch legs) - 3/4"c.
2. Switch legs - 1/2"c.

B. RIGID METALLIC CONDUIT

1. Comply with:
 - a. ANSI C80.1
 - b. UL Spec - No. 6
 - c. NEC 344
2. Conduit material:
 - a. Zinc coated or hot dipped galvanized steel.
3. Fittings:
 - a. Threaded.
 - b. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
 - c. Zinc plated or hot dipped galvanized malleable iron or steel.
4. Conduit Bodies:
 - a. Comply with ANSI/NEMA FB 1.
 - b. Threaded hubs.
 - c. Zinc plated or hot-dipped galvanized malleable iron.

C. RIGID ALUMINUM CONDUIT

1. Comply with:
 - a. ANSI C80.5
 - b. UL 6
 - c. NEC 344
2. Conduit material: Aluminum.
3. Fittings:
 - a. Threaded.
 - b. Aluminum.
 - c. Insulated bushings on terminations.

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4. Conduit bodies:
 - a. Comply with ANSI/NEMA FB 1.
 - b. Threaded hubs.
 - c. Aluminum.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with:
 - a. UL 6
 - b. ANSI C80.1
 - c. NEC. 344
 - d. NEMA RN1
 2. Conduit material: Hot-dipped galvanized rigid steel with external PVC coating, 20 mil. thick.
 3. Fittings:
 - a. Threaded.
 - b. Insulated bushings on terminations.
 - c. Zinc plated or hot-dipped galvanized malleable iron or steel with external PVC coating, 20 mil. thick.
 4. Conduit bodies:
 - a. Comply with:
 - b. ANSI/NEMA FB 1
 - c. Threaded hubs
 - d. Zinc plated or hot-dipped galvanized malleable iron with external PVC coating 20 mil thick.
- E. EMT: ANSI C80.3.
1. Comply with:
 - a. UL 797
 - b. ANSI C80.3
 - c. NEC 358
 - d. ANSI/UL797
 2. Conduit material: Galvanized steel tubing.
 3. Fittings:
 - a. ANSI/NEMA FB 1
 - b. Set screw, Die Cast for Interior Dry locations
 - c. Compression, Steel for all damp locations
- F. FMC: Zinc-coated steel or aluminum.
1. Comply with:

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- a. NEC 348
 - b. ANSI/UL 1
 - 2. Conduit material: Steel or aluminum, interlocked.
 - 3. Fittings:
 - a. ANSI/NEMA FB 1
 - b. ANSI/UL 514B
 - c. Die Cast
 - d. Threaded rigid conduit to flexible conduit coupling.
 - e. Direct flexible conduit bearing set screw type not acceptable.
- G. LFMC: Flexible steel conduit with PVC jacket.
- 1. Comply with:
 - a. NEC 350
 - b. ANSI/UL 360
 - 2. Conduit material:
 - a. Flexible hot-dipped galvanized steel core, interlocked.
 - b. Continuous copper ground built into core up to 1-1/4" size.
 - c. Extruded polyvinyl gray jacket.
 - 3. Fittings:
 - a. Threaded for rigid conduit connections.
 - b. Accepted for hazardous locations where so installed.
 - c. Provide sealing washer in wet/damp locations.
 - d. Compression type.
 - e. ANSI/NEMA FB 1.
 - f. ANSI/UL 5148.
 - g. Zinc plated malleable iron or steel.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Minimum Trade Size – 3/4"
- B. RNC: NEMA TC 2, Schedule-40-PVC, unless otherwise indicated.
 - 1. Comply with:
 - a. NEMA TC-2
 - b. UL 651
 - c. NEC 352
 - 2. Conduit material:
 - a. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.

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3. Fittings:
 - a. Comply with: NEMA TC-3 and UL 514.

2.3 EXPANSION FITTINGS

- A. Expansion fittings shall be:
 1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber - when used with rigid conduit and electrical metallic conduit, or:
 2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
 3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL Listed for the application.
 4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for acceptance prior to installation.

2.4 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).

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- c. Wiremold Company (The); Electrical Sales Division.
- d. Mono-Systems, Inc.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
- 2. EGS/Appleton Electric.
- 3. Erickson Electrical Equipment Company.
- 4. Hoffman.
- 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
- 6. O-Z/Gedney; a unit of General Signal.
- 7. RACO; a Hubbell Company.
- 8. Robroy Industries, Inc.; Enclosure Division.
- 9. Scott Fetzer Co.; Adalet Division.
- 10. Spring City Electrical Manufacturing Company.
- 11. Thomas & Betts Corporation.
- 12. Walker Systems, Inc.; Wiremold Company (The).
- 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

- 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
- 2. Concrete Ceiling Boxes: Concrete type.
- 3. Interior flush outlet boxes shall be one piece drawn galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices.
- 4. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
- 5. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be a minimum of 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece drawn 4" square x 1 1/2" deep wall boxes with appropriate 4" square cut tile wall covers. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.
- 6. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
- 7. Handy boxes shall not be used for any purpose.
- 8. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

- 1. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices. Trim rings shall also be of one-piece construction.

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2. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast iron suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.
3. Freestanding malleable iron cast boxes are to be type FSY (with flange). Cast aluminum/zinc boxes are not acceptable (Bell Boxes).

D. Floor Boxes:

1. For all slab on grade areas except wet locations and wooden floors: Cast iron or steel with epoxy paint, fully adjustable before and after the concrete pour. The cover shall provide protection from water, dirt and debris. The cover will be flanged die cast aluminum with brushed aluminum finish that will accept carpet or tile cutouts to match flooring. The box shall be capable of adapting to most power and communications needs. Provide all activations, barriers and brackets required for the particular installation. Design Selection is Wiremold RFB 4 (based on required outlets) or equal.
2. Wood Floors: Cast iron or steel fully adjustable, rectangular, multi-gang box. The cover shall provide protection from water, dirt and debris. The cover will be brass flip lids with appropriate multi gang ring to set flush with wood flooring. The box shall be capable of adapting to most power and communications needs.
3. Poke Thru's for all floor boxes in elevated slabs: Flush style round poke thru with combination power (2 duplex) and data (6 Cat6 outlets). Poke Thru shall be UL scrub water exclusion for tile and carpeted floors. Poke thru shall be maintains UL fire rated for up to 2 hour rated floors. Poke thru shall meet FBC and ADA accessibility guidelines.

E. Sheet Metal Pull and Junction Boxes: NEMA OS 1.

1. Pull and junction boxes (not in-ground type) larger than 25 square inches shall be hinged cover type with flush latches operated with screwdriver.
2. Large Pull Boxes: Boxes larger than 400 cubic inches in volume or 20 inches in any dimension:
 - a. Use continuous hinged enclosures with locking handle.
3. Exterior, damp location and wet location pull and junction boxes shall be Nema 4x stainless steel.

F. Cabinets (Control and Systems):

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Metal barriers to separate wiring of different systems and voltage.
4. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Concrete ring with Nema 6P box inside (All Areas)

1. Color of Frame and Cover: Gray.
2. Configuration: Concrete ring shall be designed for flush burial and have open bottom, unless otherwise indicated.

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3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural traffic load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE." or as indicated for each service.
6. Nema 6P box rated for direct burial enclosure shall be located inside the concrete ring for termination of conduits.
7. Handholes 36 inches wide by 36 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 - EXECUTION

3.1 RACEWAY LOCATION INSTALLATION REQUIREMENTS

A. Underground Installations:

1. Use rigid non-metallic conduit (PVC) only unless local authority having jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
2. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
3. All underground raceways shall be installed in accordance with the NEC except that the minimum cover for any conduit outside the building slab shall be two feet. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.
4. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
5. Utilize rigid steel 90° elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC.
6. All underground service lateral raceways shall be protected as required by the NEC including requirements for installation of warning tape.

B. In Slab Above or on Grade:

1. Use coated rigid steel conduit or rigid non-metallic conduit.
2. Coating of metallic conduit to be black asphaltic or PVC.

C. Penetration of Slab:

1. Exposed Location subject to damage:
 - a. Where penetrating a floor in an exposed location subject to damage from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
2. Interior Location not subject to damage:
 - a. Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40" above finished floor.

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- b. Where penetrating a floor in location other than that above, transition to metallic conduit at the floor.

D. Outdoor Location:

1. Above Grade:

- a. Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
- b. In general all exterior conduit runs shall be rigid steel conduit and threaded connectors as specified elsewhere.
- c. Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.

2. Metal Canopies:

- a. Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas is to be run underground. Clamp back spacers shall be used on all canopies to prevent galvanic action from dissimilar metals. Conduits installed exposed from Building structure to Metal Canopies will not be permitted.

3. Roofs:

- a. Conduit is not to be installed on roofs, without written authorization by A/E and the Owner for specific conditions.
- b. When accepted by written authorization conduit shall comply with the following:
 - 1) Be PVC coated rigid galvanized metal conduit.
 - 2) All fittings, etc. are to be PVC coated.
 - 3) Conduit shall be supported above roof at least 6 inches using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
 - 4) Supports to be fastened to roof using roofing adhesive or means compatible with roofing. Confirm the method used will not void the roofing warranty. The use of pitch pockets is not acceptable.

E. Interior Dry Locations:

- 1. Concealed: Use rigid galvanized steel conduit and electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" A.F.F. except where prohibited by the NEC (places of assembly, etc.).
- 2. Exposed: Use rigid galvanized steel or electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
- 3. Concealed or exposed flexible conduit:
 - a. Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than six (6) feet in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel

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conduit shall not exceed two (2) feet in length, unless written authorization by A/E for specific conditions is granted.

F. Interior Wet and Damp Locations:

1. Use rigid galvanized steel conduit.

G. Concrete Columns or Poured in-place Concrete Wall Locations:

1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).

3.2 RACEWAY INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. All bending, cutting, and reaming shall be completed with tools specifically designed for the specific use.

C. Expansion fittings shall be installed in the following cases:

1. In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints.
2. In each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other.
3. In straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

D. Arrange conduit to maintain headroom and present neat appearance.

E. Provide rigid steel long radius 90 degree sweeps (bend radius of 10 times the conduit trade size diameter) for all changes in direction (vertical and horizontal) for utility conduits. Comply with all installation requirements of the utility to utilize the conduits.

F. Utility conduits shall be buried a minimum of 36" deep to the top of the conduit.

G. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.

H. Do not cross conduits in slab.

I. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

J. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

K. Complete raceway installation before starting conductor installation.

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- L. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- M. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- N. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.
- O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pull cord must be fastened to prevent accidental removal.
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. Rigid steel box connections shall be made with double locknuts and bushings.
- R. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6" round x 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- S. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."
- T. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- U. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- V. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- W. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- X. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Z. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

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- AA. Raceways shall not be routed through stairwells, elevator shafts, elevator machine rooms or fire pump rooms unless the conduit is for use within that space.
- BB. Raceways installed in hazardous locations shall be installed in accordance with the appropriate provisions of NEC chapter 5 for that location. Confirm the appropriate space rating with life safety plans.
- CC. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- DD. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.
- EE. Excavate trench bottom to provide firm and uniform support for conduit installed underground. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter. Install backfill as specified in Division 31 Section "Earth Moving."
- FF. After installing underground conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

3.3 BOX INSTALLATION

- A. Set metal floor boxes level and flush with finished floor surface.
- B. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- C. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- D. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- H. Outlets for 120V clocks shall be recessed so that the clock will hang flush with the finished surface of the wall.

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- I. Use flush mounting outlet boxes in finished areas.
- J. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic and fire rated walls.
- K. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- L. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- N. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) all-thread rod hangers, minimum.
- O. Do not fasten boxes to ceiling support wires.
- P. Use multi-gang box where more than one device is mounted together. Do not use sectional box.
- Q. Boxes in exterior walls shall be flush mounted. Use cast outlet box in exterior locations and wet locations where flush mounting is not possible.
- R. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.
- S. Coordinate work with all divisions so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
- T. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
- U. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
- V. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.
- W. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- X. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- Y. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- Z. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

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- AA. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
- BB. Outlet boxes mounted in metal stud walls, are to be supported to studs with two (2) screws inside of outlet box to a horizontal stud brace between vertical studs or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall finished.
- CC. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
- DD. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings for installing.
- | | |
|-----------------------------|---|
| 1. Switches | 4'-0" AFF to top |
| 2. Receptacles | 1'-4" AFF to bottom |
| 3. Lighting Panels | 6'-6" AFF to centerline of highest breaker/fuse |
| 4. Phone outlets | 1'-4" AFF to bottom |
| 5. Intercom Call-in | 4'-0" AFF to top |
| 6. Fire Alarm Pull Stations | 4'-0" AFF to top |
| 7. Fire Alarm Strobe Lights | Lens is not less than 80" AFF and not more than 96" AFF |
| 8. Fire Alarm Audible Only | Not less than 90" and not less than 6" below ceiling. |
- EE. Bottoms of outlets above counter tops or base cabinets shall be minimum 2" above counter top or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on Division 26 drawings.
- FF. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.
- GG. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.
- HH. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only within a 24" wall space and that openings do not exceed 16 sq. inches.

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All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound.

- II. Fire-Barrier Penetrations: Firestop penetrations under division 07 Section "Firestopping".

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In all areas, set so cover surface will be flush with finished grade.

3.5 INSTALLATION OF WIREWAYS

- A. Do not install wireways as a substitute for proper coordination and layout of conduit stub ups to panels. Prior authorization from the engineer is required prior to installation of any wireways.
- B. Do not make splices in wireways. All wires must be pulled through without splice or termination.
- C. Install wireway to maintain headroom and to present neat mechanical appearance.
- D. Support wireway independently of conduit.
- E. Wireway shall be located so that all electrical wiring is accessible.

END OF SECTION 26 05 33

SECTION 16521 (26 56 00) - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Exterior emergency and egress lighting
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles 50 feet (15 m) or less in height is 150 mph.

1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 2. Details of attaching luminaires and accessories.
 3. Details of installation and construction.
 4. Luminaire materials.
 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 6. Photoelectric relays.
 7. Ballasts, including energy-efficiency data.
 8. Lamps, including life, output, and energy-efficiency data.
 9. Materials, dimensions, and finishes of poles.
 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 11. Anchor bolts for poles.
 12. Manufactured pole foundations.
- B. Shop Drawings:
1. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 2. Wiring Diagrams: Power and control wiring.
 3. Submit point to point photometric data at 10' intervals to 10' outside property line to verify lighting meets the requirements of State and Local lighting standards including any dark skies legislation. Required for any fixtures submitted other than the design selection fixtures.
- C. Samples for Verification: For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.
- D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- E. Operation and Maintenance Data: For luminaires and poles to include in operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle all poles in accordance with manufacturers instructions to avoid damaging poles during delivery, storage, and handling. Special attention should be given to any wrapping on the poles to make sure that the finishes are not damaged.

1.8 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranty requirements of the Contract Documents.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years.
- C. Special Warranty: Written warranty, signed by manufacturer and Installer agreeing to replace external parts of luminaires and poles exhibiting a failure of finish as specified below. This warranty is in addition to, and not a limitation of, other rights and remedies Owner may have under requirements of the Contract Documents.
 - 1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.
 - 2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.

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- K. All site lighting fixtures/luminaires that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaires as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.
- L. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, ASCE, FBC, and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.
- M. All types of labels (including manufacturer's and UL) shall be concealed within the body of the fixture, pole or accessories. The labels shall not be seen from normal viewing angles. This includes company logo's unless approved in writing by the engineer.
- N. All fixtures shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixture housing shall be closed and sealed.
- O. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- P. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- Q. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- R. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
- S. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally

colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

- a. Color: Dark bronze. Confirm color with architect prior to purchase. Architect may choose from manufacturer's standard colors.

2.3 LED LIGHTS

- A. All LEDs used in the LED fixture shall be high brightness and of proven quality from established and reputable LED manufacturers.
- B. Manufacturer shall utilize an advanced production LED binning process such as Optibin® from Philips Color Kinetics to deliver a common and repeatable color point to maintain color consistency from fixture to fixture and project to project over time, while ensuring a reliable supply of LEDs from the supplier.
- C. LED fixtures shall meet lumen maintenance standards as defined in IESNA LM-80-08.
- D. Manufacturer shall provide optical performance, polar diagrams, and photometric data in various formats including IES file format in accordance with IES LM-79-08.
- E. Photometric data shall be based on test results from an independent NIST traceable testing lab. IES data must be available and downloadable from manufacturer's Web Site.
- F. The luminaire shall contain complete prewired integral drivers and an optical assembly that shall provide a distribution of Foot candle that is consistent with FBC.
- G. Labeling shall be in accordance with ANSI standards. All units shall be UL labeled.
- H. The Luminaire shall meet ANSI 2G vibration standards.
- I. Finish shall be corrosion resistant polyester powder paint.
- J. The drivers shall be UL class II and operated in constant current mode. The drivers shall be prewired to the light engine. The Light engine assembly and housing shall be of the same manufacturer. The driver shall start and operate the light engine at ambient temperatures from - 0 degrees to 50 degree Celsius.
- K. The system must survive 120 repetitive strikes of "B2" waveforms (IEEE/ANSI C62.41.1 1991 scenario 1 location category B) at one minute intervals with less than 10 percent degradation in clamping voltage.
- L. The light engine assembly shall consist of a precision die cast aluminium heat sink, metal core printed circuit board assembly, a precision formed optical assembly comprised of injection molded high specular reflectors. The Light engine assembly shall use high brightness light emitting diodes with average CCT of 6000K and CRI greater than 70.
- M. Manufacturer shall provide a 5 year warranty.
- N. Test shall be performed to verify lumen output, life and color properties, CCT and CRI and shall be tested and measured in accordance with LM-80. Lumens depreciation shall be in

accordance with LM-80. Lumen maintenance projections shall not exceed 6X of the available system-level lumen depreciation test data. The system shall be rated at L70/B50 for not less than 50,000 hours.

- O. Manufacturer (other than the basis of design) shall provide revised photometrics for all areas to prove equal or greater photometric equivalency of the proposed LED luminaires. If additional luminaires are required, manufacturer will be responsible for all additional cost for the redesign or reconfiguration of the space.

2.4 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Wet location labeled and suitable for the environment which it is installed.
- C. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
 - 2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.5 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - 1. Emergency Connection: Operate fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

- b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
1. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by a flashing red LED. No audible alarm is permitted.
2. Suitable for installation in the fixtures and environment which it will be installed.

2.6 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
 7. Wet location labeled and suitable for the environment which it is installed.

2.7 FLUORESCENT BALLASTS AND LAMPS

- A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F (minus 18 deg C) and higher.
- B. Ballast Characteristics:
 1. Power Factor: 90 percent, minimum.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 20 percent.
 4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
 6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.
- C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.

- D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.8 BALLASTS FOR HID LAMPS

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:
 - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
 - 3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 - 4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
- B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.
- C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 - 1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
 - 2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

2.9 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - 1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.10 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Provide in line fusing and lightning arrestor in the handhole of all poles.
- C. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.11 FIBERGLASS POLES

- A. Poles: Round tapered smooth pole designed specifically for supporting luminaires, with factory-formed conduit entrance and hand hole. Not less than 65 percent E type fiberglass, with resin and pigment making up the remainder.
 - 1. Wind Loading: As shown in section 1 above.
 - 2. Resin Color: Selection of color by architect from standard colors of Black, bronze, and Gray unless otherwise noted on the schedule. Provide uniform coloration throughout entire wall thickness.
 - 3. UV Protection: Provide UV inhibitors in the resin for pole resistance from UV rays.
 - 4. Direct burial:

- a. Direct burial shall be provided with anti-rotation flare structurally integrated into the pole (below grade) during manufacture.
 - b. 2.5" X 5" hand hole located 18" above finished grade.
 - c. Appropriately sized conduit access hole 24" below grade for all required conduits.
 - d. Provide with composite guard at bottom of pole (from 4" below grade to 6" above grade minimum) to protect the pole from lawn maintenance equipment.
5. Base mounted:
- a. Provide with appropriately sized anchor bolts for the required wind loading with fixtures as shown on drawings.
 - b. 2.5" X 5" hand hole located 18" above base.
 - c. Provide one piece fiberglass shroud to cover anchor bolts. Material and color to match the pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Install luminaire in accordance with manufacturers instruction to maintain wet location listing.
- C. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- D. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 3. Trees: 15 feet (5 m).
- C. Lightning arrestor and in-line fusing are to be located at hand-hole location of pole for easy access.
- D. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

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1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers, unless otherwise indicated.
 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- F. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-fifth of pole height or manufacturers recommended installation requirements.
1. Dig holes large enough to permit use of tampers in the full depth of hole.
 2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth or 95% compaction, whichever is higher.
- G. Raise and set poles using web fabric slings (not chain or cable).

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top flush with finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."
- B. Well fixtures shall be provided with minimum 6" depth of pea gravel below fixture for drainage or as required by manufacturer.

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.5 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole, unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole.
 2. Install grounding conductor and conductor protector.
 3. Ground metallic components of pole accessories and foundations.

3.6 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.
- B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

3.8 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
 - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - e. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 56 00

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