

# Ogden High School

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Auditorium Theatrical Lighting Upgrade

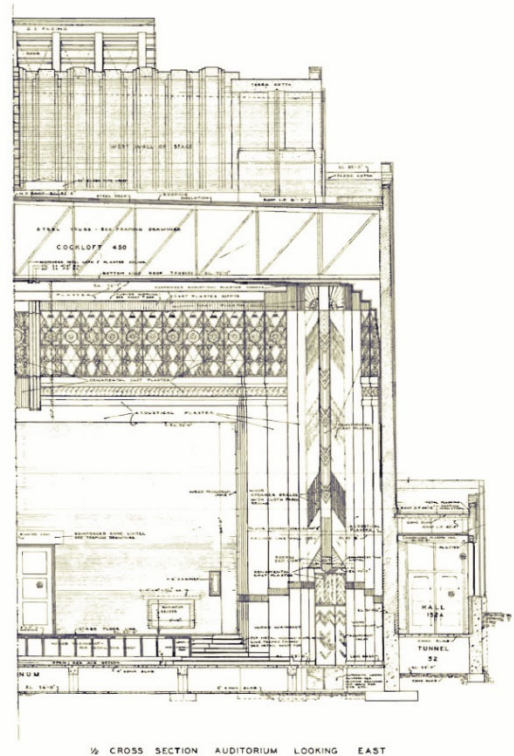
2828 Harrison Boulevard  
Ogden, Utah 84403

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FFKR Project Number 21145

Construction Documents Specifications

August 4, 2022



**FFKR** ARCHITECTS

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## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work performed by Owner.
4. Contractor's use of site and premises.
5. Work restrictions.
6. Specification and Drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 DEFINITIONS

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

#### 1.4 PROJECT INFORMATION

A. Project Identification: Heber City Bell Tower Remodel. FFKR Project #: 21145.

1. Project Location: 2828 Harrison Boulevard, Ogden, Utah 84403

B. Owner: Ogden City School District

C. Owner's Representative:

1. Ken Crawford  
Director of Support Services  
801-737-7376

crawfordk@ogdensd.org

D. Architect: FFKR Architects

1. Architect's Representative:  
Steven Cornell, AIA  
(801) 616-8297  
scornell@ffkr.com

E. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Electrical: Envision Engineering  
Electrical Representative  
Philip Borup, BSEE, LC  
(801) 534-1130  
pborup@envisioneng.com

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The project includes upgrading the theatrical lighting in the historic Ogden High School Auditorium and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.6 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.



1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
  - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
  - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

#### 1.8 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: Not Permitted.
2. Early Morning Hours: Not Permitted
3. Hours for Utility Shutdowns: 7:00 am to 6:00 pm, Monday through Friday

C. 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 for temporary utility services according to requirements indicated:

1. Notify Owner not less than 2 days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 2 days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

## 1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
  - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form acceptable to Architect.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
  - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
  - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed, unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect

will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution 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.
- b. Requested substitution does not require extensive revisions to the Contract Documents.
- c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
  - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

#### 1.3 MINOR CHANGES IN THE WORK

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

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 21 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.



- b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    - e. Quotation Form: Use forms acceptable to Architect.
  - B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
    - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
    - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - 4. Include costs of labor and supervision directly attributable to the change.
    - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
    - 7. Proposal Request Form: Use form acceptable to Architect.
- 1.5 ADMINISTRATIVE CHANGE ORDERS
- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
  - B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.
- 1.6 CHANGE ORDER PROCEDURES
- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

#### 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

#### 1.8 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Architect may issue a Work Change Directive. Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Work 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 Work 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 012600

## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
  5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 011000 "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Owner's name.
    - c. Owner's Project number.
    - d. Name of Architect.
    - e. Architect's Project number.
    - f. Contractor's name and address.
    - g. Date of submittal.
  2. Arrange schedule of values consistent with format of **AIA Document G703**.
  3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
      - 1) Labor.
      - 2) Materials.
      - 3) Equipment.
  4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of 5 percent of 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.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling 5 percent of the Contract Sum and subcontract amount.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the first day of the month. The period covered by each Application for Payment is one month, ending on the **last day of the month** prior.
  1. Submit draft copy of Application for Payment 7 days prior to due date for review by Architect.
- D. Application for Payment Forms: Use **AIA Document G702 and AIA Document G703** as form for Applications for Payment.
  1. Other Application for Payment forms proposed by the Contractor may be acceptable to **Architect** and Owner. Submit forms for approval with initial submittal of schedule of values.

- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Architect** 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  - 3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit 3 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.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from **subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application**.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. 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. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  5. Products list (preliminary if not final).
  6. Sustainable design action plans, including preliminary project materials cost data.
  7. Schedule of unit prices.
  8. Submittal schedule (preliminary if not final).
  9. List of Contractor's staff assignments.
  10. List of Contractor's principal consultants.
  11. Copies of building permits.
  12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  13. Initial progress report.
  14. Report of preconstruction conference.
  15. Certificates of insurance and insurance policies.
  16. Performance and payment bonds.
  17. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Architect issues 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.
    - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
  2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- K. Final Payment Application: After completing Project closeout requirements, 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. Certification of completion of final punch list items.
  3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  4. Updated final statement, accounting for final changes to the Contract Sum.
  5. AIA Document G706.
  6. AIA Document G706A.
  7. AIA Document G707.
  8. Evidence that claims have been settled.
  9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  10. Final liquidated damages settlement statement.
  11. Proof that taxes, fees, and similar obligations are paid.
  12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 14 of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and in prominent location in built facility. Keep list current at all times.

#### 1.5 GENERAL COORDINATION PROCEDURES

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

8. Startup and adjustment of systems.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  3. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

4. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
5. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

#### 1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Owner name.
  3. Owner's Project number.
  4. Name of Architect
  5. Architect's Project number.
  6. Date.
  7. Name of Contractor.
  8. RFI number, numbered sequentially.
  9. RFI subject.
  10. Specification Section number and title and related paragraphs, as appropriate.
  11. Drawing number and detail references, as appropriate.
  12. Field dimensions and conditions, as appropriate.
  13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  14. Contractor's signature.
  15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.

1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number, including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

## 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Architect's Data Files Not Available: Architect will not provide Architect's digital data files for Contractor's use during construction.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
  - 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
  - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 14 days after execution of the Agreement.
  - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. 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. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.

- i. Procedures for RFIs.
  - j. Procedures for testing and inspecting.
  - k. Procedures for processing Applications for Payment.
  - l. Distribution of the Contract Documents.
  - m. Submittal procedures.
  - n. Sustainable design requirements.
  - o. Preparation of Record Documents.
  - p. Use of the premises and existing building.
  - q. Work restrictions.
  - r. Working hours.
  - s. Owner's occupancy requirements.
  - t. Responsibility for temporary facilities and controls.
  - u. Procedures for moisture and mold control.
  - v. Procedures for disruptions and shutdowns.
  - w. Construction waste management and recycling.
  - x. Parking availability.
  - y. Office, work, and storage areas.
  - z. Equipment deliveries and priorities.
  - aa. First aid.
  - bb. Security.
  - cc. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 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 RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Sustainable design requirements.
    - i. Review of mockups.
    - j. Possible conflicts.

- k. Compatibility requirements.
  - l. Time schedules.
  - m. Weather limitations.
  - n. Manufacturer's written instructions.
  - o. Warranty requirements.
  - p. Compatibility of materials.
  - q. Acceptability of substrates.
  - r. Temporary facilities and controls.
  - s. Space and access limitations.
  - t. Regulations of authorities having jurisdiction.
  - u. Testing and inspecting requirements.
  - v. Installation procedures.
  - w. Coordination with other work.
  - x. Required performance results.
  - y. Protection of adjacent work.
  - z. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. 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.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. 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.
      - 1) Review schedule for next period.



- b. Review present and future needs of each entity present, including the following:
  - 1) Interface requirements.
  - 2) Sequence of operations.
  - 3) Resolution of BIM component conflicts.
  - 4) Status of submittals.
  - 5) Status of sustainable design documentation.
  - 6) Deliveries.
  - 7) Off-site fabrication.
  - 8) Access.
  - 9) Site use.
  - 10) Temporary facilities and controls.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of Proposal Requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - 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 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 meetings 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) Resolution of BIM component conflicts.
    - 4) Status of submittals.
    - 5) Deliveries.
    - 6) Off-site fabrication.
    - 7) Access.
    - 8) Site use.
    - 9) Temporary facilities and controls.
    - 10) Work hours.
    - 11) Hazards and risks.
    - 12) Progress cleaning.
    - 13) Quality and work standards.
    - 14) Status of RFIs.
    - 15) Proposal Requests.
    - 16) Change Orders.
    - 17) Pending changes.
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 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Unusual event reports.
- B. Related Requirements:
  - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
  - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time belongs to Owner.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.
  - 3. 2 paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
  - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource

loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

#### 1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.

11. Review procedures for updating schedule.

#### 1.6 COORDINATION

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

#### 1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for 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 floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  1. Temporary Facilities: Indicate start and completion dates for the following as applicable:
    - a. Securing of approvals and permits required for performance of the Work.
    - b. Temporary facilities.
    - c. Construction of mock-ups, prototypes and samples.
    - d. Owner interfaces and furnishing of items.
    - e. Interfaces with Separate Contracts.
    - f. Regulatory agency approvals.
    - g. Punch list.
  2. Procurement Activities: Include procurement process activities for any long lead-time 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.

- Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  4. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final 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: Arrange list of activities on schedule by phase.
  2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  3. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  4. 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. Building flush-out.
  5. Construction Areas: 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. Substantial Completion.
- 6.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
  1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
  1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate Final Completion percentage for each activity.
- I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- J. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  1. Post copies in Project meeting rooms and temporary field offices.



2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

#### 1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within 7 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 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

#### 1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 14 days of date established for the Notice to Proceed.
  1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

#### 1.10 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Testing and inspection.
  8. Accidents.

9. Meetings and significant decisions.
  10. Unusual events.
  11. Stoppages, delays, shortages, and losses.
  12. Meter readings and similar recordings.
  13. Emergency procedures.
  14. Orders and requests of authorities having jurisdiction.
  15. Change Orders received and implemented.
  16. Change Directives received and implemented.
  17. Services connected and disconnected.
  18. Equipment or system tests and startups.
  19. Partial completions and occupancies.
  20. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within 1 day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final Completion construction photographs.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within 3 days of taking photographs.
  - 1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description:
    - a. Name of Project.
    - b. Date photograph was taken.
    - c. Description of location, vantage point, and direction.

#### 1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

#### 1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

#### 1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
  - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
  - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
  - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
  - 5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
  - 6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
  - 7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

### 1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal Category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.
    - g. Scheduled dates for purchasing.
    - h. Scheduled date of fabrication.
    - i. Scheduled dates for installation.
    - j. Activity or event number.

## 1.5 SUBMITTAL FORMATS

### A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

### B. Options: Identify options requiring selection by Architect.

### C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

### D. Paper Submittals:

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect .
3. Action Submittals: Submit 3 paper copies of each submittal unless otherwise indicated. Architect will return 2 copies.
4. Informational Submittals: Submit 2 paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810 transmittal form.



- E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- F. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

#### 1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
    - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
  - 2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
  - 3. Paper: Prepare submittals in paper form and deliver to Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. 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.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## 1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
  - a. Manufacturer's catalog cuts.
  - b. Manufacturer's product specifications.
  - c. Standard color charts.
  - d. Statement of compliance with specified referenced standards.

- e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  - 4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  - 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. 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: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  - 2. Paper 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 42 inches**.
    - a. 3 opaque copies of each submittal. Architect will retain 2 copies; remainder will be returned.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
- 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
  - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.

- f. Specification paragraph number and generic name of each item.
- 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
- 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- 5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
- 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit 1 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit 3 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 3 sets of paired units that show approximate limits of variations.

- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
  5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
  6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit 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 substrate preparation and primers required.

2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit 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 in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit 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:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

#### 1.8 DELEGATED-DESIGN SERVICES

- 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 insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and 3 paper copies of certificate, 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.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

#### CONTRACTOR'S REVIEW

- C. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- D. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.
  - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required[, and return].
  - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
  - 2. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300



## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
  2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as indicated in-place portions of permanent construction, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
    - a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
  3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
  4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
  5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

#### 1.4 DELEGATED-DESIGN SERVICES

- 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.
- B. Delegated-Design Services Statement: 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.

#### 1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings: For [integrated exterior] [laboratory] mockups.

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

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.
  7. Time schedule or time span for tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, 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.

## 1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
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.

#### 1.10 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
  1. Provide test specimens representative of proposed products and construction.
  2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
  4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
  5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
  6. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
  7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, 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.
- K. 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 of size indicated.
  2. Build mockups in location indicated or, if not indicated, as directed by Architect.

3. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
  - a. Allow 7 days for initial review and each re-review of each mockup.
7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

#### 1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
  2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
  1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.



4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect 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. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform duties of Contractor.
- E. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspection equipment at Project site.
- F. 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 inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.12 SPECIAL TESTS AND INSPECTIONS

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

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect[ with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 014200 - REFERENCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
  - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: 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. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org).
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).

11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
34. ASSP - American Society of Safety Professionals (The); [www.assp.org](http://www.assp.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); [www.soundandcommunications.com](http://www.soundandcommunications.com).
38. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
39. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
41. AWPA - American Wood Protection Association; [www.awpa.com](http://www.awpa.com).
42. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
43. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
44. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
45. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
46. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
48. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).

50. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
51. CE - Conformance Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
52. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
53. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
54. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
55. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
56. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
57. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
58. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
59. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
60. CPA - Composite Panel Association; [www.compositepanel.org](http://www.compositepanel.org).
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - CSA Group; [www.csa-group.org](http://www.csa-group.org).
65. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
66. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
67. CTA - Consumer Technology Association; [www.cta.tech](http://www.cta.tech).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.coolingtechnology.org](http://www.coolingtechnology.org).
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); [www.decorativehardwoods.org](http://www.decorativehardwoods.org).
72. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
78. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
79. EOS/ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); [www.intertek.com](http://www.intertek.com).
82. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
83. FCI - Fluid Controls Institute; [www.fluidcontrolsintstitute.org](http://www.fluidcontrolsintstitute.org).
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
86. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
87. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; [www.floridarroof.com](http://www.floridarroof.com).
89. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
90. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
91. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).

92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
94. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
99. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
100. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
103. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
104. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
105. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
106. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
111. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
112. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.org](http://www.igshpa.org).
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; [www.ili.ai](http://www.ili.ai).
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
119. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
122. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
125. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
126. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
127. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
128. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
129. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
132. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).



- ## REFERENCES

173. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
174. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
175. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
176. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
177. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
178. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
179. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
180. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
181. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
182. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
183. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
184. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
185. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
186. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
187. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
188. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
189. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
190. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
191. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
192. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
193. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
194. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
195. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
196. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
197. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
198. TPI - Turfgrass Producers International; [www.turfgrasssod.org](http://www.turfgrasssod.org).
199. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
200. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
201. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
202. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
203. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
204. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
205. WA - Wallcoverings Association; [www.wallcoverings.org](http://www.wallcoverings.org).
206. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
207. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
208. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
209. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).
210. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
211. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).

- 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. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
  2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
- 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. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
  2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
  3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
  4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
  6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
  7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
  8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
  11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
  12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
  13. SD - Department of State; [www.state.gov](http://www.state.gov).
  14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
  15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
  16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
  17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
  18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
  19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).
- E. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.govinfo.gov](http://www.govinfo.gov).
  2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org](http://www.wbdg.org).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS; California Department of Health Services; (See CDPH).
  4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
  - 2. Section 014200 "References" for applicable industry standards for products specified.
  - 3. Section 01770 "Closeout Procedures" for submitting warranties.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model

number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.
- 1.4 QUALITY ASSURANCE
- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Resolution of Compatibility Disputes between Multiple Contractors:
    - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.

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

#### 1.5 COORDINATION

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

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

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

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
  3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."



## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  - 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:
  - 1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
  - 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
  - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
  - 1. Select products for which sustainable design documentation submittals are available from manufacturer.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
  - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
  - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."

- 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting surveys.
  - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  - 3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### 1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
  - a. Contractor's superintendent.
  - b. Trade supervisor responsible for cutting operations.
  - c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
  1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  3. Products: List products to be used for patching and firms or entities that will perform patching work.
  4. Dates: Indicate when cutting and patching will be performed.
  5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

## 1.7 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  - 2. Other Construction Elements: Do not cut and patch other construction elements or 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.
  - 3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Existing Conditions: 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, mechanical and electrical systems, and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
  2. List of detrimental conditions, including substrates.



3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to [local utility] [Owner] 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. 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.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. 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 in accordance with requirements in Section 013100 "Project Management and Coordination."

### 3.3 FIELD ENGINEERING

- A. Identification: Owner will 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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.4 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. Maintain minimum headroom clearance of **96 inches** in occupied spaces and **90 inches** in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

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.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.5 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place 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.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place 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 neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.  
Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  3. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  5. Proceed with patching after construction operations requiring cutting are complete.
- H. 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 practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical 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.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  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 in-place 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, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place 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 and ensures thermal and moisture integrity of building enclosure.

- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.6 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- 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. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000

"Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

- H. 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.
- I. 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.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8 PROTECTION AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.

#### 1.3 DEFINITIONS

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



1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in **tons (tonnes)**.
  - 4. Quantity of waste salvaged, both estimated and actual in **tons (tonnes)**.
  - 5. Quantity of waste recycled, both estimated and actual in **tons (tonnes)**.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in **tons (tonnes)**.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

#### 1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

### PART 2 - RODUCTS

### PART 3 - EXECUTION

#### 3.1 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.

- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

### 3.3 RECYCLING DEMOLITION WASTE

- A. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - 1. Pulverize masonry to maximum 3/4-inch (19-mm).
  - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- C. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- D. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- G. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- H. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- I. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- J. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- K. Conduit: Reduce conduit to straight lengths and store by material and size.
- L. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

### 3.4 RECYCLING CONSTRUCTION WASTE

#### A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

#### B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
  - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

#### C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
  - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

#### D. Paint: Seal containers and store by type.

### 3.5 DISPOSAL OF WASTE

#### A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

#### B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION 017419

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
  - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
  - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

#### 1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.5 CLOSEOUT SUBMITTALS

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

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

#### 1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect Label with manufacturer's name and model number.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  - 5. Submit testing, adjusting, and balancing records.



6. Submit sustainable design submittals not previously submitted.
  7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  6. Advise Owner of changeover in utility services.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements.
  10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. 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. 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.
- 1.8 FINAL COMPLETION PROCEDURES
- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
  5. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.9 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first listed by room or space number.
  2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the following format:
    - a. MS Excel Electronic File: Architect will return annotated file, or,
    - b. PDF Electronic File: Architect will return annotated file.

#### 1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

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

### PART 3 - EXECUTION

#### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site 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 not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. 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.
    - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
    - i. Vacuum and mop concrete.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
    - n. Clean strainers.
    - o. Leave Project clean and ready for occupancy.

- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in [Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### 1.3 DEFINITIONS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
  - 2. Submit 3 paper copies. Architect, will return 2 copies.
- C. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) 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.

#### 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.



- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

#### 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  - 2. 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.
  - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

#### 1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. 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.

E. 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.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit 1set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Final Submittal:
      - 1) Submit [one] <Insert number> paper-copy set(s) of marked-up record prints.
      - 2) Submit Record Digital Data Files and [three] <Insert number> set(s) of Record Digital Data File plots.
      - 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

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

#### 1.4 RECORD DRAWINGS

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

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Architect for resolution.
  4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
    - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enable.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 1.5 RECORD SPECIFICATIONS

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

## 1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file.
  - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

## 1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Format: Submit miscellaneous record submittals as PDF electronic file.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

## SECTION 024119 - SELECTIVE DEMOLITION

### 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. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 017300 "Execution" for cutting and patching procedures.
  - 3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.



#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition

operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

#### 1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

#### 1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.
- G. Storage or sale of removed items or materials on-site is not permitted.
- H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### 1.11 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. [Perform] [Engage a professional engineer to perform] an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

- C. Work in Historic Areas: Historic finishes and elements should be protected in place and not disturbed. Selective demolition occurring in areas designated as historic must include written plans indicating protections procedures of historic materials. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling."
- D. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119



## PART 1 - GENERAL

### 1.1 SUMMARY

#### A. Section Includes:

1. Steel supports for Schedule D pipe.

### 1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.3 ACTION SUBMITTALS

#### A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Shop primer.
3. Intermediate coats and topcoats.
4. Metal finishes.
5. Paint products.

#### B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

#### C. Samples for Initial Selection: For products involving selection of color, texture, or design.

#### D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
  - a. Show method of connecting and finishing members at intersections.

- E. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

#### 1.7 FIELD CONDITIONS

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

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

### 2.3 STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

### 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

## 2.5 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
  1. Clearly mark units for reassembly and coordinated installation.
  2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
  1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
  2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
  1. Provide weep holes where water may accumulate.
  2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove flux immediately.
  4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.
- I. Form changes in direction as follows:

1. As shown.

## 2.6 STEEL AND IRON FINISHES

- A. Shop-Painted Finish: Comply with Section 099123 "Interior Painting

1. Color: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
  1. Fit exposed connections together to form tight, hairline joints.
  2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
  3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
  4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

### 3.3 REPAIR

- A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
2. Cleaning and touchup painting of field welds, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

### 3.4 CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

### 3.5 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Primers.
  - 2. Water-based finish coatings.
- B. Related Requirements:
  - 1. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.
- B. Samples: For each type of topcoat product.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- E. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint Products: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.



## 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each paint product from single source from single manufacturer.

### 2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

### 2.3 PRIMERS

- A. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.

### 2.4 SOLVENT-BASED FINISH COATS

- A. Interior, Alkyd, Semigloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.
  - 1. Gloss Level: Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

#### 3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
  2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
  3. Allow empty paint cans to dry before disposal.
  4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 INTERIOR PAINTING SCHEDULE

#### A. Steel Substrates:

- 1. Alkyd over Surface-Tolerant Primer System”
  - a. Prime Coat: Surface-tolerant metal primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, alkyd, semigloss.

END OF SECTION 099123

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## **SECTION 26 0001**

### **ELECTRICAL GENERAL PROVISIONS**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents also apply to work of this section.

##### **1.2 DESCRIPTION OF WORK:**

- A. The contract documents indicate the extent of electrical work. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system as described in divisions 26, 27, and 28.

##### **1.3 RELATED SECTIONS:**

- A. Other Divisions relating to electrical work apply to the work of this section. See other applicable Divisions including, but not necessarily limited to:
  - 1. Division 1 – General and Supplementary Conditions
  - 2. Division 2 – Existing Conditions
  - 3. Division 3 – Concrete
  - 4. Division 5 – Metals
  - 5. Division 6 – Wood, Plastics, and Composites
  - 6. Division 7 – Thermal and Moisture Protection
  - 7. Division 8 – Openings
  - 8. Division 9 – Finishes
  - 9. Division 21 – Fire Suppression
  - 10. Division 22 – Plumbing
  - 11. Division 23 – Heating Ventilating and Air Conditioning
  - 12. Division 27 – Communications
  - 13. Division 28 – Electronic Safety and Security

##### **1.4 INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS:**

- A. Prior to bidding the job, submit requests for clarification in writing to the Architect/Engineer prior to issuance of the final addendum.
- B. After signing the contract, provide all materials, labor, and equipment to meet the intent, purpose, and function of the contract documents.
- C. The following terms used in Division 26, 27, and 28 documents are defined as follows:
  - 1. "Provide" - Means furnish, install, and connect, unless otherwise indicated.
  - 2. "Furnish" - Means purchase new and deliver in operating order to project site.
  - 3. "Install" - Means to physically install the items in-place.

4. "Connect" - Means make final electrical connections for a complete operating piece of equipment. This includes providing conduit, wire, terminations, etc. as applicable.
5. "Or Equivalent" - Means to provide equivalent equipment. Such equipment must be approved by the Engineer prior to bidding.

**1.5 EXAMINATION OF SITE:**

- A. Visit the site and verify existing field conditions prior to submitting bid.
- B. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

**1.6 QUALITY ASSURANCE:**

- A. Perform work in accordance with all governing codes, rules, and regulations including the following minimum codes (latest editions or as otherwise accepted by the Authorities Having Jurisdiction):
  1. National Electric Code (NEC)
  2. International Building Code (IBC)
  3. International Fire Code (IFC)
  4. International Mechanical Code (IMC)
  5. International Plumbing Code (IPC)
  6. American Disability Act (ADA)
  7. National Electrical Safety Code (NESC)
  8. Local Codes and Ordinances
- B. Comply with all standards where applicable for equipment and materials including the following minimum standards:
  1. Underwriter's Laboratories (UL)
  2. American Society for testing Materials (ASTM)
  3. Certified Ballast Manufacturers (CBM)
  4. Insulated Cable Engineers Association (ICEA)
  5. National Electrical Manufacturer's Institute (NEMA)
  6. American National Standards Institute (ANSI)
  7. Electrical Testing Laboratories (ETL)
  8. National Fire Protection Association (NFPA)
  9. Institute of Electrical and Electronics Engineers (IEEE)
  10. American Institute of Electrical Engineer's Electrical Power
  11. Systems and Grounding in Commercial Construction
  12. Illuminating Engineers Society (IES)
- C. Provide new electrical equipment conforming to all requirements as set forth in the above standards. Provide UL labeled equipment where such label is applicable.
- D. Comply with all state and local codes and ordinances. When conflicts occur among codes, standards, drawings, and/or specifications, the most stringent requirements shall govern.
- E. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Provide a certificate of approval to the owner's representative from the inspection authority at completion of the work.
- F. Provide only first-class workmanship from competent workers, conforming to the best electrical construction practices.

- G. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

**1.7 SUBMITTALS:**

- A. The contractor shall submit complete shop drawings and other required submittals. Incomplete submittals will be returned to the contractor unreviewed. No time extensions or cost increases will be allowed for delays caused by the return of incomplete submittals.
- B. Shop Drawings: After the contract is awarded, but prior to manufacture or installation of any equipment, submit eight (8) complete sets of shop drawings. Partially complete sets of shop drawings are not acceptable. Submit all shop drawings in one complete submittal package. Prior to submitting shop drawings, review and certify that they are in compliance with the contract documents; Sign all approved shop drawings. Allow a minimum of two weeks for architect/engineer to review shop drawings. Refer to architectural general provision section for additional requirements.
- C. Provide equipment catalog "cut sheets", brochures and/or drawings which clearly describe the proposed equipment. Include plans, elevations, sections, isometrics, and detailed engineering and dimensional information as applicable including equipment room layouts. Electrical room layouts are required to show all electrical equipment locations for all projects that include electrical rooms. Do not submit catalog sheets which describe several different items in addition to those items to be used, unless all relevant information is clearly identified. Bind each information set in three ring binder or binders of sufficient size or sizes to enclose all information. Organize all information by section. Provide separate tabbed covers for each section of Divisions 26, 27, and 28, indicating section number for each section requiring submittals.
- D. Include on front cover of binder or binders the name and location of the project, architect, electrical engineer, general contractor, electrical contractor, subcontractors, supplier/vendor, order number, volume, date, and any other applicable information. Certify that shop drawings are submitted in accordance with the contract documents with a written statement indicating compliance. Submittals will be reviewed and comments produced two times maximum. Additional reviews will be billed at current rates.

**1.8 OPERATION AND MAINTENANCE MANUALS:**

- A. Submit four (4) complete sets of operating instruction and maintenance manuals for all equipment and materials provided under Divisions 26, 27, and 28.
- B. Provide manufacturer's recommended operating and maintenance instructions, cleaning and servicing requirements, serial and model number of each piece of equipment, complete list of replacement parts, performance curves and data, wiring diagrams, warranties, and vendor's name, address, and phone numbers. Do not submit information which describes several different items in addition to those items to be used, unless all relevant information is clearly identified. Assemble all data in completely indexed volume or volumes. Engrave the job title, and name, address, and phone numbers of the contractor on the front cover and on the spine. Incomplete O&M manuals will be returned to the contractor for corrections / additions.

**1.9 RECORD DRAWINGS:**

- A. Maintain on a daily basis a complete set of "Red-Lined Drawings", reflecting an accurate record of all work including addendums, revisions, and changes. Indicate precise dimensioned locations of all concealed work and equipment, including concealed or embedded conduit, junction boxes, etc. Record all "Red-Lined Drawing" information on a set of full sized prints of



the contract drawings.

- B. Certify the "Red Lined Drawings" for correctness. Indicate on each drawing the name of the general and electrical contractors with signatures of each representative responsible for the work.
- C. The electrical engineering design firm will create record (as-built) drawings from the certified red-lined drawings; however, the general and electrical contractors retain the responsibility for the accuracy of the record drawings.

**1.10 WARRANTY:**

- A. Ensure that the electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes and is free from electrical defects. Without additional charge, replace or repair, to satisfaction of the owner's representative, except from ordinary wear and tear, any part of the installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance or as otherwise indicated in individual sections, but in no case less than one year. Warranty incandescent and fluorescent lamps only for a period of two months from the date of substantial completion.
- B. Provide complete warranty information for each item including beginning of warranty period, duration of warranty, names, addresses, and telephone numbers and procedures for filling a claim and obtaining warranty services. Written warranties and guarantees are to be submitted separately as:
  - 1. Originals bound in a binder clearly identified with the title, "WARRANTIES AND GUARANTEES," the project name, the project number, and the Contractor's business name.
  - 2. Electronic documents in \*.pdf format.

**PART 2 – PRODUCTS**

**2.1 GENERAL:**

- A. All materials shall be new and shall bear the manufacturer's name, trade name, and the approved testing laboratory such as the UL label in every case where a standard has been established for that particular material. Used materials are acceptable only if specifically indicated on drawings.

**2.2 SUBSTITUTION OF MATERIALS:**

- A. Provide only specified products or products approved by addendum. Substitutions will be considered if two copies of the proposal is received at the architect's/engineer's office eight (8) working days prior to the bid day. Include in the proposal the specified and proposed catalog numbers of the equipment under consideration and a catalog cut sheet(s) with pictorial and descriptive information. Certify that the equipment proposed is equal to that specified, that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents.
- B. It is the responsibility of the contractor to make all substituted equipment comply with the intent of the contract documents and bear all cost associated with conflicts arising from the use of substituted equipment.

- C. Provide samples if so required by the architect or engineer before or after bid day.

### **2.3 SPARE PARTS:**

- A. Provide spare parts as specified in Divisions 26, 27, and 28 sections. Deliver all spare parts to owner's representative prior to substantial completion.

## **PART 3 – EXECUTION**

### **3.1 GENERAL:**

- A. Workmanship: Provide only first class workmanship from competent workers. Defective materials or workmanship will not be allowed on the project. Provide competent supervision for the work to be accomplished. Keep same foreman on the job, unless a change is authorized by the engineer.
- B. Coordination: Prior to construction, layout electrical work and coordinate work with other trades. Sequence, coordinate, and integrate installation of materials and equipment for efficient flow of the work. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components. Coordinate with all utilities including power, communication, and data installations.
- C. Provide cutting, drilling, channeling, etc. only as necessary for proper completion of the work. Do not cut structural members unless authorization is issued in writing by the architect/engineer.
- D. Repairs: Repair damage to building, grounds, or utilities as a result of work under this contract at no additional cost to the owner.
- E. Dimensioning: Electrical drawings indicate locations for electrical equipment only in their approximate location, unless specifically dimensioned. Do not scale electrical drawings for dimensional information. Refer to architectural drawings and shop drawings where applicable for locations of all electrical equipment. Field verify all dimension on the job site.
- F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.
- G. Standards: Provide electrical installation in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- H. All workmen doing work of any nature on State of Utah projects must at all times carry their electrician's license with them and show it upon request. The acceptable ratio of apprentice to journeyman electricians on the job is 1:1.

### **3.2 REQUESTS FOR INFORMATION:**

- A. When it is clearly apparent that information is not adequately described in the construction documents or when a coordination problem exists, submit a request for information (RFI) through proper contractual channels. The electrical engineering design firm will provide a

response through its contractual channel. Although verbal direction may be given to expedite changes, responses are not considered part of the contract documents until a change order has been issued and signed by the Owner or his designated representative. The Contractor shall bear all costs associated with proceeding on any change order that has not been approved by the Owner or his designated representative.

**3.3 SAFETY PRECAUTIONS:**

- A. Provide all necessary guards or construction barriers and take all necessary precautions to insure the safety of life and property.

**3.4 CLEAN:**

- A. Clean up all equipment, conduit, fittings, wire, packing cartons, plastic, and other debris that is a direct result of the installation of the work of this division, both during the execution, and at the conclusion, of the project. Keep the site clean and safe during the progress of the work. Clean fixtures, interior and exterior of all equipment, and raceways prior to final acceptance. Vacuum interior of all electrical panels and equipment. Correct any damaged equipment. Touch-up or repaint if necessary.

**3.5 TEMPORARY POWER:**

- A. Make arrangements with the proper institution authority for all temporary electricity.
- B. Provide temporary power, complete with metering and wiring for lighting and power outlets for construction tools and equipment. Report the initial meter reading to the owner/institution, or otherwise as may be directed.
- C. Service shall be provided with a main disconnect and all 20 ampere receptacles protected by 20 amp GFI, single-pole breakers. No attempt is made herein to specify construction power requirements for equipment in detail. Provide all electrical equipment and wiring as required.
- D. As soon as permanent power and metering is available, the temporary power supply shall be disconnected and removed from the project site.
- E. All temporary wiring shall meet the requirements of NEC Article 305 and the State Industrial Commission.

**3.6 POWER OUTAGES:**

- A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the owner. Any electrical service interruption will be coordinated at least 7 days in advance of the power shut-off. Include all costs for overtime work in bid. Coordinate all outages and proceed only after receiving authorization from the owner's representative. Keep all outages to an absolute minimum.

**3.7 STORAGE AND PROTECTION OF MATERIALS:**

- A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. Lost or damaged materials will be replaced at no additional cost to owner. Do not store materials and apparatus in any public thoroughfare or in any area on the site where such storage would constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

### **3.8 EXCAVATING FOR ELECTRICAL WORK:**

- A. Verification: Prior to excavating, locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling. Observe all State and Local codes prior to excavating. Do not disturb walls, footings, and other structural members in any way.
- B. Protection: Provide barricades, warning signs, and illumination to protect persons from injury at excavations. Provide temporary coverings and heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.
- C. Coordination: Do not excavate for electrical work until the work is ready to proceed without delay.
- D. Excavated Materials: Temporarily store excavated materials near excavation in manner which will not interfere with or damage excavation or other work. Dispose of and remove excavated materials which are either in excess of quantity needed for backfilling or do not comply with the requirements for backfill material.
- E. Burial Depths: Burial depths must comply with NEC Section 300-5 (or State of Utah requirements, whichever is more stringent), unless noted otherwise on drawings.
- F. Excavation Permits: Obtain all shut-down and excavation permits as may be required for proper completion of the work.

### **3.9 BACKFILL MATERIALS:**

- A. For buried conduits or cables (other than below slab-on-grade, or concrete-encased), provide 2" thickness of well-graded sand on all sides of conduits or cables.
- B. For trench backfill to within 6" of final grade, provide soil material suitable for compacting to required densities.
- C. For top 6" of excavation, provide top soil.
- D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment:
  - 1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
  - 2. Paved Areas, other than roadways: 90 percent for cohesive soils, 95 percent for cohesionless soils.
- E. Where subsidence is observable at electrical work excavations during project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore surface to original condition.

### **3.10 ROOF PENETRATIONS:**

- A. Where raceways and/or cables penetrate roofing, provide 26 gauge galvanized iron roof jack, sized to fit tightly to raceway and/or cable for weather-tight seal, and with flange extending a minimum of 9" under roofing on all sides. Seal opening between raceway and roof jack with approved sealant. Coordinate all work with division 7.

### **3.11 FIRE PENETRATION SEALS:**

- A. Seal all raceway and/or cable penetrations through fire-rated floors, wall, and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. Provide penetration sealants and fittings of ratings to match the rating of the penetrated materials so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the NEC.
- B. Sealant Systems: Provide sealants, wall wraps, partitions, caps, and other accessories complying with UL 1479 (ASTM E-814) from the following where applicable:
  - 1. 3M Fire Barrier Sealing Penetration System
  - 2. Chase Foam Fire Stop System
  - 3. Thomas and Betts Flame Safe Fire Stop System
  - 4. Nelson Fire Stop Products
- C. Fittings: Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry wall, floor, slabs, and similar structures.
- D. Install sealants and fittings in accordance with all manufacturer's written instructions.

### **3.12 LABELING:**

- A. Engraved black plastic laminated, with white-core labels, 1/16" thick, shall be permanently attached on both the interior and exterior the following electrical equipment:
  - 1. Branch panels
  - 2. Switchgear
  - 3. Disconnect switches
  - 4. Motor starter and controls junction boxes (power and auxiliary)
  - 5. Push buttons
  - 6. Thermal switches
  - 7. Time switches
  - 8. Motor control centers
  - 9. Transformer
  - 10. Similar equipment.
  - 11. Lighting control panels
  - 12. Lighting contactors and associated switches
  - 13. Junction boxes larger than 4x4x1/2.
- B. The labels shall have 1/4" high, engraved letters, such as EF-1, AC-1, Panel A, etc.

### **3.13 CONCRETE BASES:**

- A. Housekeeping Pads: Unless otherwise noted, provide 4" high reinforced concrete bases for all floor-mounted or floor-standing electrical equipment, including but not necessarily limited to the following:
  - 1. Transformers
  - 2. Switchgear
  - 3. Motor control centers
  - 4. Generators – provide 12" high base
  - 5. Battery racks
  - 6. Similar Equipment

- B. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 380-82.
- C. Concrete bases: Refer to Section [26 0551 – Exterior Area Lighting](#).
- D. Transformer Pads: Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements.

**3.14 TESTS:**

- A. Notify engineer prior to all testing specified herein at least three business days prior to testing. Engineer shall observe all tests to insure the proper operation of the electrical system.

**3.15 PROJECT FINALIZATION AND START-UP:**

- A. Upon completion of the work, have each factory representative and/or subcontractor assist in start-up and testing of their respective systems.
- B. Have each representative give personal instructions on operating and maintenance of their equipment to the owner's maintenance and/or operation personnel.
- C. Have representatives certify each system with a written statement indicating that they have performed start-up and final check out of their respective systems.

**3.16 FINAL REVIEW:**

- A. Have the project foreman accompany their reviewing parties and remove coverplates, panel covers, access panels, etc. as requested, to allow review of the entire electrical system.

**END OF SECTION 26 0001**

**SECTION 26 0070**

**ELECTRICAL CONNECTIONS FOR EQUIPMENT**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical connections.

**1.2 DESCRIPTION OF WORK:**

- A. Extent of electrical connections for equipment include all final electrical connections for all equipment having electrical requirements including, but not necessarily limited to the following:
  - 1. Equipment specified under all divisions of the contract. Refer to other divisions for specific electrical requirements.
  - 2. Owner-furnished equipment
  - 3. Kitchen Equipment

**1.3 QUALITY ASSURANCE:**

- A. STANDARDS: Refer to [Section 26 0001 – Electrical General Provisions](#) as applicable.
- B. SHOP DRAWINGS: Not required.

**PART 2 – PRODUCTS**

**2.1 GENERAL:**

- A. Provide all materials for electrical connections including, but not necessarily limited to the following:
  - 1. Raceways
  - 2. Fittings
  - 3. Conductors
  - 4. Cords
  - 5. Cord caps
  - 6. Wiring devices
  - 7. Pressure connectors
  - 8. Lugs (CU-AL)
  - 9. Electrical insulating tape
  - 10. Heat-shrinkable tubing
  - 11. Cable ties
  - 12. Wire nuts

- 13. Other items and accessories as required.
- B. Crimp on or slip-on type splicing materials designed to be used without wire stripping are not acceptable.
- C. Power Distribution Blocks: Provide Square D Type LB or Equivalent.
- D. Refer to other Division 26, 27, and 28 Sections for specification of electrical materials as applicable.

### **PART 3 – EXECUTION**

#### **3.1 GENERAL:**

- A. Make electrical connections in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

#### **3.2 CONNECTIONS:**

- A. Permanently Installed Fixed Equipment:
  - 1. Install conductors in flexible conduit from junction box to equipment control panel or connection point.
  - 2. Where such installations are subject to moisture, install in liquid-tight flexible conduit.
- B. Movable equipment:
  - 1. Provide wiring devices, cord caps, and multi-conductor cables as required.
- C. Other methods as required by the NEC and/or as required by special equipment or field conditions.
- D. Power Distribution Blocks: Unless noted otherwise on drawings, provide power distribution blocks only for tapping of feeders and branch circuits. Locate in junction box or gutter in NEMA ratings to suit application.

#### **3.3 MANUFACTURER'S INSTRUCTIONS:**

- A. Obtain manufacturer's instruction and wiring diagram regarding electrical connections of each piece of equipment and provide connections in accordance therewith.

#### **3.4 VERIFICATION OF LOAD CHARACTERISTICS:**

- A. Verify electrical load characteristics of all equipment prior to rough-in. Review respective shop drawings of all other Divisions and Owner's equipment manuals. Report any variances from electrical characteristics noted in the contract documents to the Architect/Engineer prior to rough-in.

**END OF SECTION 26 0070**



## **SECTION 26 0072**

### **ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS:**

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

##### **1.2 SUMMARY:**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Seismic restraints for electrical equipment and systems.
  - 3. Construction requirements for concrete bases.

##### **1.3 DEFINITIONS:**

- A. IBC: International Building Code.
- B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

##### **1.4 SUBMITTALS:**

- A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.
  - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
  - 2. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:
  - 1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
  - 2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions

- c. and values of forces transmitted to the structure during seismic events.  
Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Field quality-control test reports.

#### **1.5 QUALITY ASSURANCE:**

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

### **PART 2 – PRODUCTS**

#### **2.1 MANUFACTURERS:**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### **2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS:**

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
  - 1. Available Manufacturers:
    - a. Cooper B-Line; a division of Cooper Industries.
    - b. ERICO International Corporation.
    - c. Allied Support Systems; Power-Strut Unit.
    - d. GS Metals Corp.
    - e. Michigan Hanger Co., Inc.; O-Strut Div.
    - f. National Pipe Hanger Corp.
    - g. Thomas & Betts Corporation.
    - h. Unistrut; Tyco International, Ltd.

- i. Wesanco, Inc.
  2. Finishes:
    - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
  3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- C. Raceway and Cable Supports: As described in NECA 1.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Verify suitability of fasteners in subparagraph below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
  2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Available Manufacturers:
      - 1) Hilti, Inc.
      - 2) ITW Construction Products.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co. Inc.
  3. In the following subparagraph, use stainless steel anchors in corrosive environments.
  4. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers:
      - 1) Cooper B-Line; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc
      - 3) Hilti, Inc.
      - 4) ITW Construction Products.
      - 5) MKT Fastening, LLC.
      - 6) Powers Fasteners.
  5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  6. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
  7. Toggle Bolts: All-steel springhead type.
  8. Hanger Rods: Threaded steel.

## **2.3 SEISMIC-RESTRAINT COMPONENTS:**

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
  1. Structural Safety Factor: Strength in tension, shear, and pullout force of components

used shall be at least five times the maximum seismic forces to which they will be subjected.

- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
  - 1. Available Manufacturers:
    - a. Amber/Booth Company, Inc.
    - b. Loos & Co., Inc.
    - c. Mason Industries, Inc.
  - 2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
  - 3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
  - 4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
  - 5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

## **2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES:**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in [Division 5 Section "Metal Fabrications"](#) for steel shapes and plates.

## **PART 3 – EXECUTION**

### **3.1 APPLICATION**

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for raceways as within 12 inches of coupling, fitting, and box, at each 90 degrees bend, minimum of two supports per ten foot run. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps, or as otherwise required by an agency acceptable to authorities having jurisdiction.

### **3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION:**

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.
- C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not drill or core cut holes for anchors or use powder-activated fasteners in post-tension slabs, joists, and beams.

### **3.3 INSTALLATION OF FABRICATED METAL SUPPORTS:**

- A. Comply with installation requirements in [Division 5 Section "Metal Fabrications"](#) for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.4 CONCRETE BASES:**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

- B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in [Division 3 Section "Cast-in-Place Concrete."](#)

### **3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS:**

- A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Restraint Cables: Provide slack within maximums recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

### **3.6 FIELD QUALITY CONTROL:**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing: Test pullout resistance of seismic anchorage devices.
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Record test results.

**END OF SECTION 26 0072**

**SECTION 26 0110**  
**CONDUIT RACEWAYS**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conduit raceways.

**1.2 DESCRIPTION OF WORK:**

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the followings:
  - 1. Rigid Metal Conduit
  - 2. PVC Externally Coated Rigid Steel Conduit
  - 3. Intermediate Metal Conduit
  - 4. Electrical Metallic Tubing
  - 5. Flexible Metal Conduit
  - 6. Liquid-tight Flexible Metal Conduit
  - 7. Rigid Non-metallic Conduit
  - 8. Electrical Non-metallic Tubing

**1.3 QUALITY ASSURANCE:**

- A. Standards: Refer to [Section 26 0001 – Electrical General Provisions](#) as applicable. Provide conduit raceway installation in accordance with recommendations of the American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest edition.
- B. Manufacturers: Firms regularly engaged in the manufacture of raceway of types and sizes required, whose products have been in satisfactory service for not less than three (3) years.
- C. Shop Drawings: Not required.

**PART 2 – PRODUCTS**

**2.1 CONDUITS:**

- A. Rigid Metal Conduit (RMC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in accordance with Federal Specification WW-C-0581 and ANSI C80.1.
- B. PVC Externally Coated Rigid Metal Conduit: Provide hot-dipped galvanized, rigid metallic conduit externally coated with Polyvinyl Chloride (PVC) in accordance with ANSI C80.1 and NEMA Std. Pub. No. RN 1.

- C. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in accordance with Federal Specification WW-C-581.
- D. Electric Metallic Tubing (EMT): Provide electric metal tubing in accordance with Federal Specification WW-C-563 and ANSI C80.3.
- E. Flexible Metal Conduit: Provide zinc-coated, flexible metal conduit in accordance with Federal Specification WW-C-566.
- F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit, constructed of single strip, flexible continuous, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid-tight jacket of flexible Polyvinyl Chloride (PVC).
- G. Rigid Non-Metallic Conduit: Provide rigid non-metallic conduit (PVC) in accordance with ANSI/NEMA TC 2, Type 1 for concrete encasement, Type 2 for direct burial.

## **2.2 FITTINGS:**

- A. Rigid Metal Conduit, Intermediate Metal Conduit, and PVC Externally Coated Rigid Metal Conduit: Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.
- B. Electric Metallic Tubing: Provide insulated throat, non-indenter, set screw, malleable steel fittings. Screws must have a full set. Provide concrete-tight compression-type fittings in suspended slabs. All EMT fittings shall be fabricated from steel. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable. Install OZ Type B bushings on conduits 1" and larger.
- C. Flexible Metal Conduit: Provide flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 1, and Style A. Commercial "greenfield" not less than 1/2" diameter or as otherwise specified on drawings is acceptable.
- D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 3, Style G.
- E. Non-Metallic Conduit: Provide non-metallic conduit fittings (PVC) in accordance with ANSI/NEMA TC 3 to match conduit types and materials.
- F. Expansion Fittings: OZ Type AX, or equivalent to suit application.
- G. Sealing Bushings: Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ Type CSB internal sealing bushings.
- H. Cable Supports: Provide OZ cable supports for vertical risers, type as required by application.

## **2.3 SIZES:**

- A. Provide conduits in sizes as indicated in contract documents or as otherwise specified herein, but not less than 3/4". Minimum sizes for data conduits is 1".

## **PART 3 – EXECUTION**



**3.1 GENERAL:**

- A. Install raceway and accessories in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

**3.2 LOCATIONS:**

- A. Rigid Metal Conduit and Fittings: Use for conduit bends greater than 22 degrees where buried below grade or slab on grade. Install RMC where raceway passes vertically through slab-on-grade. Where raceways penetrate building, manholes, or vault walls and floors below grade, provide RMC for a minimum distance of 10' on the exterior side of the floor or wall. Use RMC for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.
- B. Intermediate Metal Conduit and Fittings: Use for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.
- C. Electric Metal Tubing and Fittings: Use for above-grade feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Install in suspended slabs subject to local code requirements and fire rating considerations.
- D. Flexible Metal Conduit and Fittings: Use as whips for lighting fixtures, fixed equipment where not exposed to weather or moisture, other devices where required by NEC, and as requested by the Engineer. Maximum length not to exceed 6', unless specifically approved by the Electrical Engineer.
- E. Liquid-Tight Flexible Metal Conduit and Fittings: Use for connection to motor terminal boxes, fixed equipment where subject to moisture or weather, and other equipment subject to movement or vibration. Maximum length not to exceed 6', unless specified otherwise.
- F. Rigid Non-Metallic Conduit and Fittings: Use for below-grade service entrances, feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Do not use above grade.

**3.3 METHODS:**

- A. Maintain a minimum of 12" clearance between steam or hot water lines or other hot surfaces. Where such clearance is impractical, insulate conduit with approved materials.
- B. Install conduits parallel with or at right angles to lines of the structure. Route conduits symmetrically where possible.
- C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.
- D. Precaution shall be exercised to prevent accumulation of water, dirt or concrete in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.

- E. Any conduit which pierces airtight spaces or plenums shall be sealed to prevent air leakage with mastic acceptable to the Architect.

### **3.4 CONCEALING:**

- A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas. In equipment rooms, if lighting raceways are run exposed, installation shall not be done until piping and duct work layout has been determined in order that lighting boxes may be located so as to avoid being covered by overhead ducts and piping. If lighting raceways in equipment rooms are concealed in the structural ceiling slab, after mechanical work is complete, exposed conduit extensions shall be run to locate lighting fixtures where they are not obscured by work of other trades.

### **3.5 BURIED CONDUITS:**

- A. Comply with all burial depths as defined in NEC Section 300-5. Bury all conduits at least 24" below grade, unless specifically indicated otherwise on drawings. Provide magnetic 6" wide "Yellow Warning" ribbon 12" directly above conduit and 6" below finished grade measured from the top of the conduit or duct bank. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single marker.
- B. Slope all conduits toward manholes or pull boxes for proper drainage. Use weep holes. Gravel drainage pockets are not permitted.
- C. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.
- D. Under Concrete Slab on Grade: Horizontal conduit must be installed a minimum of 2" below the bottom of the concrete slab. Conduits should not be installed in concrete slabs.
- E. Concrete Encasement: Where concrete-encasement is indicated on drawings, provide duct bank construction using red 3000 psi at 28 day strength concrete. Provide minimum 4" cover on all sides of exterior conduits. Provide conduit spacers where applicable. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.
- F. Where conduits are extended for future use, cap and clearly mark.

### **3.6 ELECTRICAL CONTINUITY:**

- A. Provide electrically continuous conduit systems throughout.

### **3.7 FIELD CUTS AND THREADS:**

- A. Cut all conduits square. Remove all sharp or rough edges and ream all burrs, inside and outside. Provide clean sharp threads on RMC and IMC.
- B. Engage at least five full threads on all RMC and IMC fittings. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

### **3.8 SUSPENDED SLABS:**

- A. When conduit is installed in the suspended slab, it shall be limited to conduits having a diameter

of 1" (25 mm) or less, or less than 1/3 the concrete cover, and no crossovers occur, and conduit spaced at least 18" (450 mm) apart with a 3/4" (20 mm) cover.

**3.9 CONDUIT ENDS:**

- A. Cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

**3.10 SPARE CONDUITS:**

- A. Provide five (5) 3/4" empty conduits from recessed branch panelboards to accessible ceiling spaces and five (5) 3/4" conduits into accessible floor space. When floor is not accessible, provide six (6) 3/4" empty conduits from panelboard to accessible ceiling space. Cap and label all conduits.
- B. Install a 200 lb. polypropylene pull cord in each empty conduit run.

**3.11 POWER COMPANY RACEWAY METHODS:**

- A. Comply with all Power Company Requirements.
- B. The contractor shall provide all conduit systems for the required electrical utility work; raceway shall be PVC or RMC. All elbows shall be long-radius PVC, RMC, or fiberglass elbows complying with all ESR requirements. Sleeve conduits when conduit extends vertically through a paved surface. Provide 500 lb flat pull line or poly rope within each conduit. Proof all conduits with an 80% diameter mandrel witnessed by the Utility representative.
- C. The contractor shall provide trenching, boring, backfill, compactions, and surface repair.
- D. The contractor shall provide pre-case concrete pad/vaults for utility provided transformers as required.
- E. The contractor shall provide concrete pads for utility provided transformers as required.
- F. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

**3.12 HAZARDOUS LOCATIONS:**

- A. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

**3.13 CLEANING:**

- A. Pull mandrel and swab through all conduits before installing conductors.

**END OF SECTION 26 0110**

**SECTION 26 0120**  
**CONDUCTORS AND CABLES**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conductors and cables.

**1.2 DESCRIPTION OF WORK:**

- A. This section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Types of conductors and cables in this section include the following:
  - 1. Copper Conductors.
  - 2. Aluminum Conductors.
  - 3. MC Flexible Metal Clad Copper Cables.
  - 4. Flexible Cords.
- C. Applications for conductors and cables required for project include:
  - 1. Electrical service.
  - 2. Feeders.
  - 3. Branch Circuits.

**1.3 SUBMITTALS:**

- A. Product Data: For each type of conductor and/or cable indicated.
- B. Field Quality-Control Test Reports: From Contractor. Refer to [Section 26 0001 – General Electrical Provisions](#).

**1.4 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 GENERAL:**

- A. Manufacturers: In other Part 2 articles where subparagraph titles below introduce lists, provide products by the manufacturer specified, subject to compliance with requirements.
- B. Ambient Conditions: Conductors used for branch circuits in areas where the ambient conditions exceed 30 degree C. shall be provided with insulation approved for that temperature.
- C. Wire Sizes: As indicated on electrical drawings or as specified herein, but in no case less than No. 12 AWG.

## **2.2 COPPER CONDUCTORS:**

- A. Manufacturers:
  - 1. Cerro Wire & Cable Company.
  - 2. General Cable Technologies Corporation.
  - 3. Encore Wire Corporation.
  - 4. Southwire Incorporated.
- B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.
- C. References and Ratings:
  - 1. ICEA S-95-658 / NEMA WC70.
  - 2. ASTM.
  - 3. UL Standard 83.
  - 4. UL Standard 1063 (MTW).
  - 5. Federal Specification J-C-30B.
  - 6. NEC.
- D. Conductor Material: Copper.
- E. Stranding: Solid conductor for No. 12 AWG, stranded for No. 10 AWG and larger.
- F. Conductor Insulation Types: Thermoplastic-insulated, Type THHN / THWN-2.

## **2.3 ALUMINUM CONDUCTORS:**

- A. Manufacturers:
  - 1. Alcan Aluminum Corporation; Alcan Cable Div.
- B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.
- C. References and Ratings:
  - 1. ICEA S-95-658 / NEMA WC70.
  - 2. Federal Specification J-C-30B.
  - 3. ASTM Standards B 800 and B 801.
- D. Conductor Material: Aluminum.
- E. Stranding: STABILOY compact stranded conductor (AA-8000 Series aluminum alloy).
- F. Conductor Insulation Types: Black cross-linked polyethylene (XLPE), Type XHHW-2.

## **2.4 MC FLEXIBLE METAL CLAD COPPER CABLES:**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
- B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.
- C. References and Ratings:
  - 1. UL 83, 1479, 1569, 1581, File Reference E80042.
  - 2. NEC 230-43, 300-22(c), 318, 321, 334, 518, 520, 530, 645.
  - 3. Federal Specifications J-C-30B.
  - 4. Meets all applicable OSHA and HUD requirements.
  - 5. May be surface-mounted or embedded in plaster.
  - 6. UL rated for Cable Tray and Environmental Air-Handling Space installation; 1, 2 and 3-hour through-penetration Fire Wall rated.
- D. Conductor Material: Copper.
- E. Stranding: Solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- F. Conductor Insulation Types: Type THHN.
- G. Armor: Galvanized steel.
- H. Assembly Covering: Mylar Tape.
- I. Grounding: Insulated green grounding conductor.

## **2.5 FLEXIBLE CORDS:**

- A. Manufacturers:
  - 1. Cerro Wire & Cable Company.
  - 2. General Cable Technologies Corporation.
  - 3. Encore Wire Corporation.
  - 4. Southwire Incorporated.
- B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.
- C. References and Ratings:
  - 1. ASTM.
  - 2. ICEA.
  - 3. UL 62.
  - 4. Pendant or portable.
  - 5. Damp locations.
  - 6. 600 Volts.
  - 7. NEC Article 400.
- D. Conductor Material: Copper.
- E. Stranding: Class K, flexible stranded conductor.

- F. Conductor Insulation Types: Heat- and moisture-resistant TPE insulation.
- G. Fillers and Wrapping: Non-wicking polypropylene fillers, with tissue-paper separator wrapped around the assembly.
- H. Outer Jacket: Black-colored, heat-, moisture-, and oil-resistant TPE jacket.
- I. Grounding: Insulated green grounding conductor.
- J. Cord Type: SO, hard-usage.

## **2.6 CONNECTORS AND SPLICES:**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. AMP Incorporated/Tyco International.
  - 3. Hubbell/Anderson.
  - 4. O-Z/Gedney; EGS Electrical Group LLC.
  - 5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Splices for wire sizes #10 and smaller shall be screw-on type similar to scotch or ideal wing nut connectors. Crimp-on splices designed to be used without wire stripping are not acceptable.

## **PART 3 – EXECUTION**

### **3.1 GENERAL:**

- A. Install conductors, cables, and accessories as indicated, in compliance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standards of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

### **3.2 CONDUCTOR AND CABLE APPLICATIONS:**

- A. Service Entrance: As indicated on the electrical drawings.
- B. Feeders: As indicated on the electrical drawings.
- C. Branch Circuits:
  - 1. Exposed, including in crawlspaces: Copper conductors in raceway. In finished ceiling areas, conduits shall be painted to match the surrounding surface.
  - 2. Concealed in gypsum board ceilings, walls, and partitions: Copper conductors in homerun raceways from electrical panelboards to first outlet box; MC flexible metal clad copper cables are allowed for connection of wiring devices, light fixtures, and equipment at load end and in dry and concealed locations only. MC cables are not allowed in CMU or concrete walls.
- D. Cord Drops, Reels, and Portable Appliance Connections: Flexible cord.

- E. Class 1 Control Circuits: Copper conductors in raceway.

### **3.3 INSTALLATION:**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. When raceway is not required, install concealed cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.
- E. Support cables according to other applicable specification sections.
- F. Seal around cables penetrating fire-rated elements to comply with applicable fire stop specification sections.
- G. Color Coding: Color code secondary service, feeder, and branch circuit conductors. Colors shall remain consistent throughout the project and shall match existing coding system where applicable.
  - 1. Conductor sizes No. 6 AWG and smaller: Colored insulation.
  - 2. Conductors sizes No. 4 AWG and larger: 2 inch (51 mm) band of Colored adhesive marking tape applied at all terminations, junction boxes, and pull boxes.
  - 3. Branch circuit switched-legs and travelers: Colored insulation (in colors other than those indicated below).
  - 4. Color-code 120/208V system conductors:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral A: White with Black stripe.
    - e. Neutral B: White with Red stripe.
    - f. Neutral C: White with Blue stripe.
    - g. Neutral (Shared when allowed): White
    - h. Ground: Green.
    - i. Isolated Ground: Green with yellow tracer.
  - 5. Color-code 277/480V system conductors:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Neutral A: Gray with Brown stripe.
    - e. Neutral B: Gray with Orange stripe.
    - f. Neutral C: Gray with Yellow stripe.
    - g. Neutral (Shared when allowed): Gray.
    - h. Ground: Green.

### **3.4 HOMERUN CIRCUITS:**

- A. Homerun circuits may be combined in common conduits at the option of the contractor in compliance with the following:



1. Three-Phase Installations: Not more than three single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a, b, or c).

### 3.5 NEUTRAL CONDUCTORS:

- A. LINE-TO-NEUTRAL BRANCH CIRCUITS: For multi-phase branch circuits, provide an oversized common neutral conductor sized one size (AWG) larger than the largest phase conductor; for 120/208V, 3-Phase systems, provide UL-Listed common handles on circuit breakers; for 277/480V, 3-Phase systems, provide multi-pole circuit breakers. For 277V branch circuits only, a dedicated neutral may be provided for each circuit in conjunction with 20A-1P breakers in lieu of shared neutrals with multi-pole breakers.

### 3.6 VOLTAGE DROP:

- A. Provide branch circuit conductors in sizes such that voltage drop for branch circuits do not exceed 3 percent at the farthest outlet. Provide service, feeder, and branch circuit conductors so that the voltage drop on the entire electrical system does not exceed 5 percent at the farthest outlet. This shall be strictly followed regardless of the conductor sizes indicated on the electrical drawings. Increase conductor sizes (and conduits where necessary to comply with NEC conduit fill requirements) as necessary to accommodate this requirement. Calculations shall be based on the following:
  1. Lighting Branch Circuits: Connected load plus 25% spare.
  2. Appliance and Equipment Branch Circuits: Nameplate or NEC required load.
  3. 120V Convenience Outlet Branch Circuits: 12 amps minimum, but in no case less than NEC loading requirements. Use the following schedule:

<u>Distance (feet)</u>	<u>Wire Size (AWG)</u>
0-80	#12
81-125	#10
126-200	#8
201-320	#6

4. Use the NEC method to calculate voltage drop.

### 3.7 CONNECTIONS:

- A. All connections shall be made using a torque wrench. 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. Provide a report indicating the actual torque values utilized on all feeders 100 amp and greater.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack. Use pig tails when wiring outlets.

### 3.8 FIELD QUALITY CONTROL:

- A. Testing: Perform the following field quality-control testing:

1. Visual and Mechanical Inspection:
    - a. Inspect cables for physical damage and proper connection in accordance with the electrical construction documents.
    - b. Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench.
    - c. Check cable color coding for compliance with electrical specifications.
  2. Electrical Tests:
    - a. Perform insulation resistance test on each conductors for feeders 100 amps and greater with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
    - b. Perform continuity test to insure proper cable connection.
  3. Test Values:
    - a. Minimum insulation resistance values shall not be less than two megaohms.
  4. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test Reports: Prepare a written report and submit to the Electrical Engineer at the completion of the project. The report shall include the following:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

**END OF SECTION 26 0120**

**SECTION 26 0135**  
**ELECTRICAL BOXES AND FITTINGS**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical boxes and fittings.

**1.2 DESCRIPTION OF WORK:**

- A. Extent of electrical boxes and fittings work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings in this section include the following:
  - 1. Outlet Boxes
  - 2. Junction Boxes
  - 3. Pull Boxes
  - 4. Floor Boxes
  - 5. Conduit Bodies
  - 6. Bushings
  - 7. Locknuts
  - 8. Knockout Closures
  - 9. Miscellaneous Boxes and Fittings

**1.3 QUALITY ASSURANCE:**

- A. Standards: Refer to [Section 26 0001 – Electrical General Provisions](#) as applicable.
- B. Manufacturers: Firms regularly engaged in the manufacturer of boxes and fittings required, whose products have been in satisfactory service for not less than three years.
- C. Shop Drawings: Submit shop drawings on floor boxes only where required.

**PART 2 – PRODUCTS**

**2.1 INTERIOR OUTLET BOXES:**

- A. General: Provide one piece, galvanized or cadmium-plated, flat-rolled, sheet steel interior outlet boxes of types, shapes, and sizes to suit respective location and installation. Construct with stamped knockouts on back and sides and with threaded screw holes. Provide corrosion-resistant screws for securing boxes, covers, and wiring devices. Size all junction boxes in accordance with NEC Table 314.16(A), with a minimum box size of 4" x 4" x 1-1/2". Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".

Gangable boxes shall not be used.

- B. Switch, Telephone, and Receptacle Outlets: Provide outlet boxes not less than 4" square, with adapting tile or plaster covers where necessary to set flush with finished surfaces. Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Gang boxes shall be used where more than one switch or device is located at one point. Sectional Boxes are not acceptable. In masonry walls where tile or plaster ring cannot be used, install a single-gang 3-1/2" deep box minimum, unless otherwise noted. Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".
- C. Lighting Outlets:
  - 1. Lay-in Grid: Outlets for recessed fixtures in acoustical tile ceilings shall be located to center on a single tile or at the intersection of four tiles.
  - 2. Surface-mounted: Provide 4" square octagonal outlet boxes for surface-mounted, ceiling fixture outlets. Mount each box independently of the conduit on standard 3/8" stud or approved box hangar where applicable. Include backing and supports as required to carry 200 lbs. Where three or more raceway entrances are made, use a minimum box depth of 2-1/8".

## **2.2 WEATHERPROOF OUTLET BOXES:**

- A. Provide corrosion-resistant, cast-metal weatherproof outlet boxes, of types, shapes, and sizes, with threaded conduit ends, cast metal coverplates with spring-hinged waterproof caps, face plate gaskets, and corrosion-resistant fasteners.

## **2.3 JUNCTION AND PULL BOXES:**

- A. Provide code-gauge sheet steel junction and pull boxes, with removable screw-on covers and welded seams, of types, shapes, and sizes to suit each respective location and installation. Size all junction and pull boxes in accordance with NEC 314.28. Provide stainless steel nuts, bolts, screws, and washer.

## **2.4 FLOOR BOXES:**

- A. Provide steel or PVC, weatherproof, concrete-tight floor boxes of types, shapes, and sizes to suit each respective location and installation. Where multi-service floor boxes are indicated, provide floor boxes sized to accommodate wiring devices and communication outlets shown on drawings. Construct floor boxes with fully adjustable leveling screws, and knockouts as required to accommodate specified conduits.
- B. Provide floor boxes from the following manufacturers:
  - 1. Bell Electric
  - 2. Crouse-Hinds
  - 3. Hubbell
  - 4. Steel City
  - 5. Thomas&Betts
  - 6. Wiremold

## **2.5 CONDUIT BODIES:**

- A. Provide galvanized, cast-metal conduit bodies of type, shapes, and sizes to suit respective locations and installation. Construct with threaded conduit entrance ends and removable covers. Provide corrosion-resistant screws.

- B. Aluminum boxes and fitting shall not be permitted.

## **2.6 CONDUIT CONNECTIONS:**

- A. Box connectors 3/4" and larger shall be insulated, throat-type or equal type plastic bushings. Provide double locknuts and insulating plastic bushings for RMC and IMC terminating at panels and boxes.
- B. Where RMC penetrates building, manholes, or vault walls and floors below grade, provide sealing bushings with external membrane clamps as applicable. Provide segmented internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway. Where RMC terminates in manhole, vault, or pull box, provide insulated grounding bushings.
- C. Install OZ type "B" connectors for all conduits 1" and larger.
- D. Provide cable supports in all vertical risers in accordance with NEC 300-19.

## **2.7 EXPANSION FITTINGS:**

- A. Provide expansion joint fittings in all conduit runs crossing structural expansion joints, whether above-grade, in slab-on-grade, or in suspended slabs. Provide OZ type "AX" or approved equivalent, size to the raceway.

## **2.8 ACCESSORIES:**

- A. Provide all accessories including, but not necessarily limited to, bushings, knockout closures, locknuts, offset connectors, etc. of types, shapes, and sizes to suit respective locations and installation. Construct of corrosion-resistant steel.

# **PART 3 – EXECUTION**

## **3.1 GENERAL:**

- A. Install electrical boxes and fittings in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

## **3.2 METHODS:**

- A. Where outlet boxes are subject to weather or moisture, install weatherproof outlet boxes.
- B. Remove knockouts only for entering conduits. Provide knockout closures to cap unused knockout holes where blanks are mistakenly removed.
- C. Do not use condulets in place of elbows or junction boxes. Condulets in sizes 2" or larger shall not be used, unless specifically approved by the electrical engineer.
- D. Install boxes and conduit bodies in readily accessible locations. Install recessed boxes with faces of boxes or rings flush with finished surfaces. Seal all openings between outlet box and adjacent surfaces with plaster, grout, or similar suitable material.

- E. For stud construction, install boxes with rigid supports using metal bar hangers, or 2" X 4", 1" X 6" wood bridging between studs with screws. Welding or nailing boxes directly to metal joist and studs is not acceptable. Boxes set opposite in common wall shall have at least 10" of conduit between them. Securely fasten outlet boxes to structural surfaces to which attached.
- F. For concrete or masonry construction, solidly embed electrical boxes in concrete and masonry. Provide box supports as required to keep outlet boxes flush with finished surfaces.
- G. Coordinate location of all outlet boxes with millwork, back splashes, tackboards, etc.
- H. Install junction boxes or condulets in conduit runs as required at 100 foot maximum intervals on long runs. This shall apply to concrete junction boxes in grade and junction boxes within the building.
- I. Provide electrical connections for installed boxes.

### **3.3 IDENTIFICATION:**

- A. Mark circuit number on exterior side of junction boxes located in ceilings such that circuit numbers are readily identifiable. For outlet boxes in wall, mark circuit numbers on interior sides of outlet boxes.
- B. In each outlet, tag each wire to identify which circuit it serves. Label outlet boxes and inside of covers with circuit and panel numbers in permanent marker.
- C. Identification labels shall be as follows:

Normal Power	Black with White letters
Emergency Power	Red with White Letters

**END OF SECTION 26 0135**

## **SECTION 26 0140**

### **WIRING DEVICES**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to wiring devices.

##### **1.2 DESCRIPTION OF WORK:**

- A. Extent of wiring device work is indicated by drawings and schedules.
- B. Types of electrical wiring devices in this section include the following:
  - 1. Toggle Switches
  - 2. Receptacles
  - 3. Floor Service Outlets
  - 4. Poke-Through Assemblies
  - 5. Special Purpose Outlets
  - 6. Cord Caps and Connectors

##### **1.3 QUALITY ASSURANCE:**

- A. STANDARDS: Refer to [Section 26 0001 – Electrical General Provisions](#) as applicable.
- B. SHOP DRAWINGS:
  - 1. Submit manufacturer's data on all electrical wiring devices.
  - 2. Where occupancy sensors are required, provide scaled drawing showing manufacturer's recommended locations.

#### **PART 2 – PRODUCTS**

##### **2.1 GENERAL:**

- A. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA standards Pub No. WD 1; nylon construction, 20 amp rating minimum.
- B. Provide wiring devices in colors selected by Architect/Engineer. Provide red receptacle outlets where devices are circuited to standby power.

##### **2.2 TOGGLE SWITCHES:**

- A. Provide toggle switches from one of the following manufacturers (Fed-Spec):

<u>Manufacturer</u>	<u>1-Pole</u>	<u>3-Way</u>	<u>4-Way</u>	<u>W/Pilot</u>
Hubbell	HBL1221	1223	1224	1221-PL
Pass & Seymour	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	1221	1222	1223	1221-PLR
Cooper	2221	2223	2224	2221-PL
Bryant	4901	4903	4904	4901-PL

- B. Abbreviations are defined as follows:

- 1-Pole - Single-Pole Toggle Switch
- 3-Way - Three-Way Toggle Switch
- 4-Way - Four-Way Toggle Switch
- W/Pilot - Single-Pole Toggle Switch with Pilot Light

- C. Must be back and side wired, and have color-coded covers, Brass terminal screws, back wire ground clamp, and self-grounding clip.

## 2.3 RECEPTACLES:

- A. Provide duplex receptacles from one of the following manufacturers:

<u>Manufacturer</u>	<u>CO</u>	<u>GFCI</u>	<u>IG</u>
Hubbell	5362	GF5362	5362IG
Pass & Seymour	5362	2091-S	IG6300
Cooper	5362	VGF20	IG5362
Bryant	5362	GFR53FT	5362IG

- B. Where duplex receptacles are shown with an "H" subscript on the electrical drawings, provide hospital Grade devices from one of the following manufactures:

<u>Manufacturer</u>	<u>CO</u>	<u>GFCI</u>	<u>IG</u>
Hubbell	HBL8300WH	HGF8300W	IG8300
Pass & Seymour	9300-HGW	2091-SHGW	IG9300-HG
Cooper	8300W	GF8300W	IG8300W
Bryant	8300-W	GFR83FT-W	8300-IG

- C. Where duplex receptacles are shown with an "USB" subscript on the electrical drawings, provide hospital Grade devices from one of the following manufactures:

<u>Manufacturer</u>	<u>CO</u>
Hubbell	USB8300W

Other Manufacturers of USB outlets may be considered for approval during the bidding period. Approval is subject to adherence with the prior approval process. Refer to Section 26 0000, "General Electrical Provisions".

- D. Abbreviations are defined as follows:

- CO- Convenience Outlet Duplex Receptacle



2. GFCI- Ground Fault Circuit Interrupter duplex Receptacle
3. IG- Isolated Ground Duplex Receptacle

- E. Must have one-piece Brass back strap and back wire grounding clamp (Does not apply to GCFI or isolated ground).

#### **2.4 FLOOR SERVICE OUTLETS:**

- A. Provide all receptacles and special purpose outlets required in floor boxes. See [Section 26 0135 – Electrical Boxes and Fittings](#). Provide coverplates, carpet flanges, etc. in finishes or colors selected by Architect/Engineer.

#### **2.5 POKE-THROUGH ASSEMBLIES:**

- A. Provide factory-assembled, poke-through assemblies equipped with wiring devices as specified herein. Construct of materials to maintain fire rating of suspended slab with pre-wired conduit, fire barriers, toggle arm assemblies, service fittings, integral junction box, etc. Provide coverplates, carpet flanges, etc. in finishes or colors selected by Architect/Engineer. Provide Poke-through assemblies of one of the following:

1. Hubbell
2. Thomas&Betts
3. Wiremold

#### **2.6 SPECIAL PURPOSE OUTLETS:**

- A. Provide special purpose outlets of voltage and ampere ratings, and NEMA configurations to suit respective application. Refer to drawings for NEMA configuration. Provide special purpose outlets in amperages at least as large as the overcurrent protective device from which they are served.

#### **2.7 CORD CAPS AND CONNECTORS:**

- A. Provide cord caps and connectors of voltage and ampere ratings, and NEMA configurations which mate and match with outlets specified as required for final connections for equipment. Provide cord caps and connectors of one of the following:

1. Hubbell
2. Pass & Seymour
3. Leviton
4. Cooper
5. Bryant

#### **2.8 COVERPLATES:**

- A. Wall Plates: Provide coverplates for all wiring devices. In all finished areas, provide stainless steel coverplates. Provide ganged coverplates for all switches and/or dimmers. Provide pre-marked coverplates for special purpose outlet indicating voltage, amperages, and phase. Provide raised stamped, galvanized, steel plates in all unfinished areas. Provide weather-proof coverplates for outlets exposed to weather and moisture.
- B. Weather-Protecting Device Enclosure: Where required for compliance with NEC 410-67 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wiring device. Provide units which mount on either single or double gang devices.

Provide device enclosures manufactured by one of the following:

1. Intermatic WP1020 or WP1030
2. Hubbell WP826MP
3. Pass & Seymour

### **PART 3 – EXECUTION**

#### **3.1 GENERAL:**

- A. Install wiring devices and accessories in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to insure that products fulfill requirements.

#### **3.2 METHODS:**

- A. Install wiring devices only in electrical boxes which are clean and free from excess building materials, dirt, and debris. Do not install wiring devices until painting work is completed.
- B. Replace receptacles and/or coverplates which are damaged, stained, or burned.

#### **3.3 GFCI RECEPTACLES:**

- A. Provide separate neutral conductor from panel to each GFCI receptacle circuits.
- B. Install GFCI receptacles for all receptacles installed in restrooms, outdoors, or within six feet of any sink. All receptacles in kitchens shall be GFCI protected.
- C. Do not wire standard receptacles on the load side of GFCI receptacle - Install GFCI receptacles.

#### **3.4 DIMMERS:**

- A. Provide separate neutral conductor for each phase of the branch circuit on which dimmers are installed.
- B. Provide dimmers in wattage ratings that will support the maximum potential wattage of the fixtures that are being dimmed. Do not size dimmers based on actual lamps installed in light fixtures, but on maximum lamp wattage ratings of light fixtures on that particular circuit.

#### **3.5 GROUNDING:**

- A. Provide electrical continuous, tight, grounding connections for wiring devices.

#### **3.6 TESTING:**

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

#### **3.7 IDENTIFICATION:**

- A. All devices shall be identified on the cover plate with the panel board name and the circuit number by a black on clear adhesive label.

- B. In each outlet, tag each wire to identify the circuit it serves.

**END OF SECTION 26 0140**

**SECTION 265561**  
**THEATRICAL 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. Section Includes:
  - 1. Dimmer racks.
  - 2. Control console and control devices.
  - 3. Luminaires and accessories.
  - 4. Distribution components.

**1.3 DEFINITIONS**

- A. Fade Time: The time it takes all zones to fade from one lighting scene to another, with all zones arriving at the next scene at the same time.
- B. Control Voltage: As defined in NFPA 70, term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.
- C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
- D. Channel: An individual control output on a control console, accessed and regulated by a slider, switch, or button; or in some cases, accessed by a discretely assigned address and regulated by a data input apparatus.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For theatrical lighting.
  - 1. Include plans, elevations, sections, mounting, and attachment details.
  - 2. Detail fabrication and installation for dimmer racks and arrangements, characteristics, and circuit assignments of various modules and rack-mounted accessories.
  - 3. Elevation views of front, rear, and side panels indicating devices and controls, including illustrations and dimensioned outline drawings.
  - 4. Include diagrams for power, signal, and control wiring. Show connections, circuits, and channel assignments.

5. Equipment legend showing a unified system of designations for lighting instruments, panels, dimmers, circuits, and equipment.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Floor plans, reflected ceiling plan(s), and other details drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Required working clearances for operation, maintenance, and environmental conditions.
  2. Areas above and around dimming equipment where piping and ducts are prohibited.
  3. Rack layout and relationships between components and adjacent structural and mechanical elements.
- B. Qualification Data: For Installer.
- C. Seismic Qualification Certificates: For lighting equipment and distribution equipment from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires, distribution components, software operating manuals, and controls to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Instructional DVD: Professionally produced informational presentation to provide comprehensive instructions for equipment installation, connectivity, programing, and functional use. Information provided shall be specific to equipment provided for Project and shall include ancillary equipment and its integration into the theatrical lighting control system.
  2. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Control-Console Introduction:
      - 1) Descriptions of controls and features.
      - 2) Software instruction manuals.
      - 3) Setup requirements for unit and related equipment.
      - 4) Default settings.

- 5) Maintenance procedures and schedules.
  - b. Control-Console Operation:
    - 1) Elementary on-off operation.
    - 2) How to set cues manually.
    - 3) How to patch dimmer to channels electronically.
    - 4) How to operate presets manually.
    - 5) How to operate fundamental memory.
    - 6) How to set and record simple cues.
    - 7) How to recall, play back, and revise cues and scenes.
    - 8) How to use submasters, groups, focus points, fader channels; and how to split cues, store and recall programs, set up special effects, and print out cues.
    - 9) How to set up and run system for a typical event or performance.
    - 10) How to get help.
  - c. Dimming Racks:
    - 1) Descriptions of features, functions, and safety and security precautions.
    - 2) Descriptions of dimming module features, software-driven functions, non-dim functions, and associated racking systems.
    - 3) How to compare connected loads against dimmer capacity ratings.
    - 4) How to terminate basic power-in and power-out connections.
    - 5) Basic maintenance requirements, including need for qualified electrician for internal maintenance; basic maintenance schedule; techniques for keeping terminals properly tightened, filter screens clean, and overheat sensors checked; and techniques for performing other required servicing.
    - 6) How to adjust dimmer-control module.
    - 7) How to get help.
    - 8) Description of warranty.
  - d. System Troubleshooting: Procedures for handling problems with common software, programming, control console, dimmer rack, and distribution system; include information on how to get help.
- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On USB drive or compact disk, complete with data files.
  3. Device address list if applicable.
  4. Printout of software application and graphic screens.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Dimmer Modules: One of each type and rating installed.
  2. Fuses: Three of each kind.
  3. Lamps: one for every 10 of each type and rating installed. Furnish at least one of each type.

4. Glass Roundels: One for every three of each type and color installed. Furnish at least one of each type.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of the complete dimming control system and luminaires that fail in materials or workmanship within specified warranty period.
  1. Lamps are not included as part of the special warranty. Verify available warranties for units and components.
  2. Warranty Period: Cost to repair or replace parts for two years from date of Substantial Completion.
  3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years.

## PART 2 - PRODUCTS

### 2.1 APPROVED MANUFACTURERS

- A. Manufacturers / Installers: Subject to compliance with requirements, provide products by one of the following and as indicated on the Drawings:

<u>Manufacturer</u>	<u>Telephone</u>
Electronic Theatre Controls	(608) 831-4116

### 2.2 APPROVED THEATRICAL DEALERS/INTEGRATORS

<u>Dealer/Integrator</u>	<u>Telephone</u>
Oasis Stagewerks	801-363-0364
Barbizon Light of the Rockies	303-394-9875
Upstage Services	801-779-3030

### 2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Dimmer racks shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

## **2.4 PLUG CONNECTORS**

- A. Twist-Locking Type: NEMA WD 6, two pole, three wire, 20 A.

## **2.5 UNISON ERN SERIES CONTROL ENCLOSURES**

- A. Control Enclosures
  1. The control enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.
  2. Mechanical
    - a. The External Processing enclosure shall be a surface mounted panel constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
      - 1) The enclosure door shall have an opening to allow limited access to the control module face panel.
      - 2) Enclosures shall be convection cooled without the use of fans.
    - b. Control Enclosures shall be sized to accept one or two Control Processors and one or two Station Power Modules, including various options and accessories.
      - 1) The Control Enclosure for a single control processor (ERn2) shall support a single Station Power Supply module; The Control Enclosure for 2 control processors (ERn4) shall support a quantity of 2 modules.
    - c. All enclosure components shall be properly treated and finished.
      - 1) Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.
    - d. Enclosure(s) shall also be available in a 19" rack mounted (RM) version.
      - 1) Rack-mounted version shall have an independent enclosure suspension kit, with a full height, locking door/cover attached to the kit.
      - 2) Rack-mounted version shall have an opening to access the control module face panel, and openings to view indicators on option modules.
    - e. Enclosure dimensions and weights (without modules) shall not exceed:
      - 1) ERn2 - 15" W x 9" H, 10" D, 15 lb
      - 2) ERn2-RM - 19" W 11"H 10" D, 20 lb.



- 3) ERn4 - 15" W x 14" H x 10" D, 20 lb.
  - 4) ERn4-RM - 19" W x 16" H x 10" D, 25 lb.
- f. Top, bottom, and side knockouts shall facilitate conduit entry.
- g. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.
- 1) Supports shall be provided for precise alignment of modules into power and signal connector blocks.
  - 2) With modules removed, enclosures shall provide clear front access to all power and control wire terminations.
- h. Option Modules
- 1) Ethernet Switch
    - a) The Control Enclosure shall support an optional 5-port Ethernet Switch, with at least 4 ports supplying Power over Ethernet (PoE).
    - b) The Ethernet Switch module shall be 100BaseTX, auto MDI/MDIX, 802.3af PSE compliant.
    - c) The Ethernet Switch module shall contain power, status, and activity indicators. All indicators shall be visible when the enclosure door is open for both rack and wall mounted ERn.
  - 2) Redundant Power Supply (RRPS)
    - a) The Control Enclosure shall support an optional redundant power supply which shall automatically provide power to the control electronics upon failure or removal of the primary power supply.
    - b) The redundant power supply shall assert itself seamlessly without a loss of power to the control electronics.
    - c) The redundant power supply shall seamlessly remove itself when the primary power supply is reengaged.
    - d) The redundant power supply shall provide visible indication that it is active.
  - 3) Station Bus Repeaters (ERn4 only)
    - a) The Control Enclosure shall support an optional module to expand the station bus length an additional 400 meters, and the station count an additional 30 stations (60 maximum per processor/enclosure)
    - b) Wall-mount and 19" Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure.
  - 4) Station Bus Dual Repeaters (ERn4 only)
    - a) The Control Enclosure shall support an optional module to expand the station bus length to two additional 400 meter segments (a total of 1200 meters from a single enclosure, and the station count to 60 stations (60 maximum per processor/enclosure).
    - b) Wall-mount and 19" Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure.

i. Accessories

1) RideThru Option (RTO)

- a) The Control Enclosure shall support an optional, short-term back-up power source for the control electronics.
- b) RideThru Option (RTO) provides power for controls electronics during brief power outages or drop outs.
- c) The short-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
- d) The short-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
- e) The short-term back-up power source shall support the control electronics for at least 10 seconds.

2) Battery Pack Option (BPO)

- a) The Control Enclosure shall support an optional, long-term back-up power source for the control electronics.
- b) The long-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
- c) The long-term back-up power source shall supply power to the control electronics for at least 90 minutes.
- d) The long-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
- e) A test switch/indicator shall be available without opening the rack door or removal of any modules/components.

3. Electrical

- a. External Processing enclosures shall be available in 100, 120, 230 and 240 volt, single-phase configurations.
- b. External Processing enclosures shall be completely pre-wired by the manufacturer. The contractor shall provide input and control wiring.
- c. External Processing enclosures shall be designed to support the following wire terminations:

- 1) AC (single phase)
- 2) Echelon link power (Belden 8471 or equivalent)
- 3) 24Vdc (2- 16AWG Wire)
- 4) DMX512A Port A (In or Out) (Belden 9729 or equivalent)
- 5) DMX512A Port B (In or Out) (Belden 9729 or equivalent)
- 6) RS232 Serial In/Out (Belden 9729 or equivalent)
- 7) Unshielded Twisted Pair (UTP) Category 5 Ethernet
- 8) Contact Closure In (14AWG to 26AWG Wire)
- 9) Contact Closure Out (14AWG to 26AWG Wire)

- a) Contact Closure Out shall provide 1A @ 30vDC

d. Station Power Modules

- 1) Station power supply modules shall provide LinkPower for at 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.
- 2) Station power repeater modules shall provide LinkPower for 30 stations and 1.5A@24VDC of Auxiliary (AUX) power.
- 3) Station power module shall support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.
  1. All control wire connections shall be terminated via factory provided connectors.

e. Thermal

- 1) Ambient room temperature: 0-40°C / 32-104°F
- 2) Ambient humidity: 10-90% non-condensing

## 2.6 ARCHITECTURAL CONTROL PROCESSOR MODULES

A. Control Processor Modules

1. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
  - a. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.
  - b. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
  - c. ACP module electronics shall be contained in a plug-in assembly.
    - 1) The module shall be housed in a formed steel body and contain no discrete wire connections.
      - a) No tools shall be required for module removal or insertion.
  - d. The ACP shall be convection cooled.
  - e. User Interface
    - 1) The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
    - 2) The ACP shall provide an alpha-numeric keypad for data entry and navigation
    - 3) The ACP shall provide a touch-sensitive control wheel for navigation.
    - 4) The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
    - 5) The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
      - a) The backlight shall have a user selectable time out, including no time out.
  - f. The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.

- 1) The Ethernet port shall be secured behind the locking door.
  - g. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
    - 1) The SD slot shall be secured behind the locking door.
  - h. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
    - 1) The USB port shall be secured behind the locking door.
  - i. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
    - 1) The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
    - 2) The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.
    - 3) The ACP data can be exchanged by inserting the CF card into another ACP.
3. Electrical
- a. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
  - b. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
  - c. The ACP shall be hot-swap capable.
  - d. The ACP shall support Echelon LinkPower communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.
    - 1) The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.
    - 2) The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
    - 3) Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m)
    - 4) Link power wiring between stations shall not exceed 1313 ft. (400m).
  - e. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
  - f. The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
  - g. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.\*

- 1) \*When used in a Dimming Enclosure, the second port is always an output port.
  - h. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
  - i. The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.
4. Functional
- a. Capacity
    - 1) Shall support 1024 channels of control
    - 2) Shall support 2 physical DMX ports, each of which may be configured as an input or output
  - b. System
    - 1) Runtime application shall utilize support Net3 system interoperability
    - 2) System shall support the use of Network Time Protocol for real time clock synchronization
    - 3) System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
    - 4) System shall support local firmware upload from removable media (SD Card, USB Flash Drive)
  - c. Diagnostics
    - 1) Shall output an Event log
    - 2) Standard log shall store a fixed-length history of recent activity
    - 3) Separate critical log shall only store important messages (such as boot-up settings)
  - d. Configuration Data
    - 1) Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application
    - 2) Configuration Data can be retrieved from another Paradigm Processor
    - 3) A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism
    - 4) Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
    - 5) Configuration Data may be loaded to and from removable media access provided on front panel
    - 6) Configuration Data for the entire System shall be available for download from any single Processor
    - 7) Shall store configuration data for Dimming enclosure processors and shall make available for download
  - e. Scalability

- 1) Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size
- 2) The maximum number of Processors configured as a System shall be at least 12
- 3) Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
- 4) Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
- 5) Failure of a single Processor shall not prohibit continuing operation of the remaining Processors
- 6) It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems

f. Local User Interface

- 1) Shall provide access to Processor setup (IP address)
- 2) Shall provide access to Processor status and diagnostics
- 3) Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics
- 4) Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
- 5) Shall provide functionality to schedule astronomical and real time events (add/edit/delete)
- 6) Shall allow for display of local DMX information
- 7) Shall allow for transfer of log files to local removable media
- 8) Shall allow to perform firmware upgrades for connected Dimming enclosures
- 9) Shall allow for transfer of configuration to and from Dimming enclosures using removable media
- 10) Shall allow for transfer of configuration to and from LCD Stations using removable media
- 11) Shall allow for binding of Stations

g. Access Controls

- 1) There shall be 2 user accounts - Administrator, and User with separate password protection
- 2) Account and password settings shall be local to each Processor
- 3) Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface

h. Web User Interface

- 1) Shall be an internal web server accessible via Ethernet port
- 2) Shall support common web browsers on Windows and Mac platforms
- 3) Shall provide functionality to Activate and Deactivate Presets
- 4) Shall provide functionality to schedule timed events (add/delete)
- 5) Shall display status information
- 6) Shall display log files
- 7) Shall allow for configuration of Processor settings (date, time)
- 8) Shall allow for upload and download of configuration data

- 9) There shall be links to other web-enabled devices in the System, including other Paradigm Processors
- i. Stations
  - 1) Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet
  - 2) Station discovery and binding shall be accomplished from the Local User Interface or Light Designer
- j. Net3 and ACN Devices
  - 1) Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet
  - 2) Paradigm Processors shall provide DMX-Net3 gateway functionality
  - 3) It shall be possible to send and receive Macro triggers defined within the System configuration via Net3
  - 4) There shall be support for Streaming ACN on up to 24 universes per Processor
- k. Operation
  - 1) When contained in an dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
  - 2) DMX output refresh rate shall be configurable
  - 3) There shall be support for 16-bit DMX Attributes
  - 4) DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
  - 5) Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
  - 6) Where there are multiple external sources then priority and HTP shall be used to perform arbitration
  - 7) External and internal sources shall be arbitrated based on user-selection of standard or custom rules
  - 8) On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
  - 9) The total output may be the combination of many different Presets running concurrently
  - 10) There shall be no hard limit on number of concurrent cross fades
  - 11) Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence(LTP) or Highest Takes Precedence (HTP)
  - 12) LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP
  - 13) Settings due to LTP Presets may be automatically discarded from operation when overridden
  - 14) It shall be possible to specify that a Preset or Attribute Control will persist when overridden
  - 15) A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
  - 16) It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System

- 17) Each Preset shall have a status that can be Activated, Deactivated or Altered
- 18) Preset status may be set based on matching levels in the current output as an option
- 19) On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day

I. Serial Input/Output

- 1) RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
- 2) RS232 shall support baud rates from 4800 to 115,200 bps
- 3) Serial input and output messages are fully customizable
- 4) Serial output messages can be generated by any Control or Event

**2.7 CENTRAL LIGHTING SERVER**

- A. The Architectural Control Server shall be the Unison Paradigm Central Control Server (P-CCS) as manufactured by Electronic Theatre Controls, Inc., or equal.
1. Connections shall be made between lighting system components over standard Ethernet distribution systems using 10/100BaseT.
  2. The server shall be tested to UL standards and labeled ETL Listed
  3. The server shall be RoHS Compliant (lead-free)
  4. The server shall be CE compliant
- B. Mechanical
1. The Central Control Server (P-CCS) assembly shall be designed for use with Unison Paradigm Series Control Systems
  2. P-CCS electronics shall be contained in a single assembly.
    - a. The assembly shall be housed in a formed steel body
    - b. The server shall be fabricated of 16-gauge steel, finished in fine-texture, scratch-resistant, powder coat paint
    - c. Mounting holes shall be provided for installation of a rack mount kit
  3. User Interface
    - a. The P-CCS power button shall be backlit for use in low-light conditions.
  4. The P-CCS shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
  5. The P-CCS shall provide rear-panel connections for (2) RJ45 jack for Ethernet connection to the processor for configuration, Virtual Touchscreen (VTS) and web-browser-based system access.
  6. Architectural Lighting System configuration and program information shall be stored in solid state memory, which does not require battery backup.
    - a. The P-CCS shall provide a hard drive for storage of system configurations
- C. Electrical



1. The P-CCS shall support 100-240VAC power input and utilize an external transformer power supply
2. The P-CCS shall allow for nearly silent operation
3. The server shall utilize microprocessor based, solid state technology to provide multi-processor lighting and building control
4. The server shall provide two IEEE802.3u Ethernet connections for 100BASE-TX communication with the lighting control system
  - a. The Primary Ethernet port shall be reserved for connection to the lighting control system
  - b. The Secondary Ethernet connection shall be used for interface with BACnet IP enabled building systems
  - c. Both Connections shall support Virtual Touchscreen (VTS) functionality
5. Following a loss of power, the P-CCS shall return to its previous power state upon power being restored

D. Environmental

1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F)
2. The storage temperature shall be -40° to 70°C (-40° to 158°F)
3. The operating humidity shall be 5% - 95% non-condensing

E. Functional

1. Capacity
  - a. Shall support up to 48 Paradigm Architectural Control Processors (ACP)
  - b. Shall support up to 12 individual projects
2. System
  - a. Shall support multi-user LiveControl and LiveEdit simultaneously
  - b. System shall support the use of Network Time Protocol for real time clock synchronization
  - c. System shall support remote firmware upload over an Ethernet connection from a connected PC running the LightDesigner software
  - d. Failure of a single Processor shall not prohibit continuing operation of the remaining connected system
  - e. Shall log system error messages using Syslog
  - f. The server shall support ANSI E1.17 Architecture for Control Networks (ACN)
  - g. Servers that do not support ANSI E1.17 shall not be acceptable
  - h. The server shall support ANSI/ASHRAE BSR135.1 BACnet IP protocol.
    - 1) Servers that do not support BSR135.1 shall not be acceptable
3. Diagnostics
  - a. Shall output an Event log using Syslog format
  - b. Standard log shall store a fixed-length history of recent activity
  - c. Separate critical log shall only store important messages (such as boot-up settings)

4. Configuration Data
  - a. Configuration Data can be uploaded over an Ethernet connection from a PC running the LightDesigner application
  - b. Configuration Data can be retrieved from any connected Paradigm Processor
  - c. Configuration Data may be loaded to and from removable media (USB) access provided on front panel
  - d. Configuration Data for the entire System shall be available for download from any Processor or Central Server
  - e. Configuration Data shall be stored on solid-state media
5. Scalability
  - a. Adding additional Processors to a Server System shall proportionately increase its overall capabilities up to a maximum System size
  - b. The maximum number of Processors configured as a single System shall be at least 12.
  - c. The maximum number of Paradigm Processors supported by a single Server configuration shall be at least 48
  - d. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
  - e. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
  - f. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems
  - g. Shall provide building management interface separate from the Lighting Network using BACnet IP
    - 1) Shall allow for system Timed Event scheduling from another device
  - h. Shall allow remote use of the customized Virtual Touchscreen Application (VTS)
6. Web User Interface
  - a. Shall be an internal web server accessible via the primary Ethernet port
  - b. Shall support common web browsers on Windows and Mac OS platforms
  - c. Shall provide functionality to Activate and Deactivate Presets
  - d. Shall provide functionality to schedule timed events (add/delete)
  - e. Shall display status information
  - f. Shall display log files
  - g. Shall allow for configuration of Processor settings (date, time)
  - h. Shall allow for upload and download of configuration data
  - i. There shall be links to other web-enabled devices in the System, including other Paradigm Processors
7. Virtual Touchscreen Stations
  - a. A Virtual Touchscreen (VTS) interface shall be supported from the Central Control Server
  - b. General
    - 1) Virtual Touchscreen stations shall support default and fully graphical control pages.

- 2) The Virtual Touchscreen station shall operate using graphic buttons, faders and other images with support for at least 30 separate programmable control pages.
- 3) Virtual Touchscreen stations shall also allow programming of page pass-code, lock out and visibility levels.

c. Functional

1) System

- a) The Virtual Touchscreen shall support configuration firmware upload from a Paradigm Central Control Server as proxy
- b) The Virtual Touchscreen shall support client application download from the Paradigm Central Control Server
- c) A minimum of 48 Virtual Touchscreens Stations shall be supported for the Central control Server
- d) Virtual Touchscreens shall support user configurable resolutions up to 1080 HD (1920 x 1080)
- e) Virtual Touchscreen Station shall support configuration form ControlDesigner Software

2) Setup Mode

- a) There shall be a setup display that is separate from any user-defined configuration
- b) It shall be possible to view and modify connectivity settings
- c) It shall be possible to view status information
- d) The appearance of the setup display shall be standard and not editable
- e) The setup display may be invoked from within the user-defined configuration and/or physical button on the Virtual Touchscreen
- f) There shall be a default protected method to invoke the setup display

3) Configurations

- a) Only one VTS configuration may be active on a single interface
- b) Where multiple configurations are stored there shall be a boot menu to allow selection of a configuration
- c) Each configuration shall be identified as a different Station within the System

4) Operation

- a) The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Virtual Touchscreen controls. System shall allow the control of presets, sequences, macros and time clock events.
- b) System macros and sequences shall be programmable via LightDesigner system software.
- c) System time clock events shall be programmable via the Virtual Touchscreen, LightDesigner system software, the processor user interface, or the internal web server.

- d) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
  - e) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
  - f) A Color picker, supporting Hue, Saturation and Brightness (HSB) color selection shall be available for color selection of color changing fixtures and provide visual feedback of the current color produced by the associated fixture.
    - 1. The color picker shall be provided with a default layout that requires no user configuration
    - 2. The Color Picker shall provide RGB faders in addition to the default HSB color wheel for color selection
    - 3. Color picker values shall allow for numerical value input in addition to color wheel and fader control
    - 4. The color picker shall be compatible with color mixing systems that use up to seven discrete color control channels
  - g) Virtual Touchscreen stations shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
    - 5. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, and cue light, or room join/separate.
    - 6. Optional fader functions include master control, individual channel control, fade rate control or preset master control.
8. Portable Plug-in Stations
- a. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
  - b. Mechanical
    - 1) Unison connector stations shall provide an interface to portable Unison stations.
    - 2) All connector stations shall be available with white, cream, ivory, gray or black faceplates.
      - a) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
    - 3) All faceplates shall be designed for flush or surface mounting.
    - 4) Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
    - 5) Station faceplates shall be indelibly marked with station function.
    - 6) The manufacturer shall supply back boxes for all surface mounted stations.
  - c. Electrical

- 1) Unison control station wiring shall be an Echelon® Link power network.
    - a) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
    - b) Portable plug-in stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
    - c) Network wiring may be bus, loop, home run, star or any combination of these.
    - d) Wiring termination connectors shall be provided with all stations.
  - 2) Portable Plug-in Stations shall offer the following Regular markings
    - a) UL and cUL LISTED
    - b) CE Market
    - c) RHoS and WEE Compliant
- d. Functional
- 1) The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
    - a) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
      7. Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
      8. Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
    - b) System macros and sequences shall be programmable via LightDesigner system software.
      9. Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
      10. Macro and sequences shall be activated by button, time clock event or LightDesigner software.
    - c) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
      11. Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
      12. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

- 2) Control components shall be designed to operate default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the software-based configuration program.
  - a) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, or room join/separate.
  - b) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

## 2.8 BUTTON AND FADER STATIONS

### A. General

1. The lighting control desk shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The device shall be the Ion as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The system shall provide control of from 1024 to 6144 outputs, in 512 output increments, on a maximum of 16,000 control channels, patched across any number up to 99,999. Output shall be distributed over a 10/100MB Ethernet network using Net3/ACN, ETCNet 2, Avab and/or ArtNet protocols. The user shall be able to control the application of protocols at an individual address level.
3. The system shall support full bi-directional RDM communication with compatible devices via Net3 DMX/RDM Gateways. RDM communication shall adhere to ANSI standard E1.20-2006 Entertainment Technology – RDM – Remote Device Management over DMX512 Networks. Supported RDM features shall include:
  - a. Discovery and identification of RDM capable devices
  - b. Setting of start addresses, operating modes and additional settings as exposed by connected devices and controllable via RDM
  - c. Viewing of Sensor data as provided by connected devices
  - d. Error reported as provided by connected devices
4. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros, 999 submasters, 1000 curves, 1000 color paths and 1000 snapshots may be contained in non-volatile electronic memory and stored to an onboard solid-state hard drive or to any USB storage device.
5. Recorded cue lists may be played back simultaneously on a maximum of 200 faders. Channels shall respond to cue information by last instruction with discrete rate control provided for all cues. The desk may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade control and priority status may be placed on each cue list. It shall also be possible for a cue list to contribute to playback background states or to withhold such contributions.
6. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.
7. Up to six USB fader wings may be connected to the desk, for a maximum of 300 loaded submasters and/or 200 playback faders. USB fader wings may be rigidly connected to the main desk to provide a "single connected unit" with no external cables required. The wings also may be connected via USB cables and used "on the side." Virtual fader control is also provided.

8. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of non-intensity parameters. Non-intensity encoders may be operated in coarse or fine mode, with the amount of movement per revolution of the encoders in coarse mode definable by the user. Non-intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device. A high-resolution rate wheel shall also be provided.
9. Rotary encoders for non-intensity parameters shall be labeled by means of an integral LCD display mounted below the encoders on the main desk. The display shall show the currently loaded functions of the encoders based on the current selections. Systems using encoders with no LCD labeling shall not be acceptable.
10. Virtual moving light controls shall provide mouse/touch-based tools for all parameters. The tools shall display the current value for each parameter and shall provide controls for adjusting each parameter.
11. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and matching to color media data.
12. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high-resolution DVI monitors, or one Display port monitor, which may also be touch or multi-touchscreen(s). Only one display shall be required for operation. Content of all displays and individual workspaces shall be zoomable. Each display shall have 3 definable workspaces; each workspace with split controls allowing sizing of frames. Single monitor snapshots with an on-screen browser shall provide rapid reconfiguration of workspaces.
13. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.
14. A fully integrated Virtual Media Server feature shall allow the user to map images and animations to a rig array. 40 such maps may be created, each with 12 layers. Systems that rely on external hardware or software for this functionality shall not be acceptable.
15. User-definable, interactive displays may be created. These displays, which can be used in live and blind operating modes, allow graphical layout of channels, desk buttons and programming tools. Standard symbols are provided, and the user may import their own symbols or graphics. Each symbol may be individually defined with data feedback characteristics. Non-interactive status information, such as a mirror of other user's command lines, may also be included in the display. A graphical browser is provided for fast selection of these views. Multiple zoom factors and placements may be stored and recalled for each display.



16. An optional, full-functioning, detachable alphanumeric keyboard shall be supported. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. Hotkey functionality is also supported. An integral electronic keyboard shall be provided.
17. A row of softkeys shall be provided, which change function based on the selection and context of the desk. These softkeys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using softkeys with no LCD display shall not be acceptable.
18. Software upgrades shall be made by the user via a USB port. It shall be possible to install software updates in all consoles, processor units and remotes from one device over the network.
19. The operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the device shall return to its last output state when power is restored.
20. Dimmer monitoring and configuration features shall be provided (in conjunction with ETC's Sensor+, Sensor 3 or FDX dimming systems) to allow indication of dimming system status, dimmer load monitoring and show specific configurations.
21. Show data may be created and modified on a personal computer, using Windows 7/8+ operating systems, with a free offline editing application. The offline editor may also run natively on Intel-based Macintosh platforms using OS X. The program shall also allow output to visualization software supporting the same protocols as the lighting system.
22. A PC using Windows 7/8+ or an Intel-based Macintosh computer using OS X running the offline editing software shall be able to connect to a control system via the network and view or modify current show data in an independent display environment, using an ETCnomad key. When connected without the key, the computer shall operate in Mirror Mode, with the device to be mirrored selectable by the user. Systems that do not provide client software that may run natively on the Apple platform in this environment shall not be acceptable.
23. Synchronized backup shall be provided via another full desk on the network, by use of a remote processor unit or an ETCnomad. Available output is determined by the lowest output configuration between the primary and the backup. The backup device shall maintain synchronized playback with the primary and shall take over control of the lighting system upon loss of communication with the primary. Use of two RPU's to service and backup system output is also supported. Systems that do not offer this kind of instant backup from multiple sources shall not be acceptable.

24. A maximum of four users may access and interact with show data simultaneously. Each user shall have an individual workspace and channel partitioning shall be supported. User identification may be assigned to more than one control device, allowing users to work in tandem, or allowing a designer/ALD to mirror the current display format, mode and command line of the associated programmer. Partitioned control allows discrete control of channel/parameter groupings by user. Partitioned control may be easily enabled and disabled with no need to merge show data from multiple users.
25. Mirror mode shall allow the desk displays and operating modes to be mimicked on another connected device.
26. The system shall support up to 32 individual Time Code Event lists.

B. Controls and Playback

1. Manual Control and Programming Section
  - a. The programming keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls.
  - b. Non-intensity parameters may be set numerically or via the encoders. This control shall be fully interactive. In either case the current parameter value shall be displayed on the desk monitor and simultaneously on the integral LCD display.
  - c. Only those parameters available for control in the active lighting system shall be displayed for control.
  - d. Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a "control channel" for accessing these functions shall not be required and systems requiring use of a control channel shall not be acceptable.
  - e. Fan functions shall be provided both via command line operation and through encoder controls.
  - f. Highlight shall be supported, with user definable highlight values. Lowlight conditions may be defined for selected, but not specified channels. Rem Dim command, at specific levels by channel, may be optionally and automatically called with the highlight command.

- g. Fixtures with color mixing may be set with direct additive or subtractive encoder controls or the command line, as well as via the color pickers. Six optional color spaces are supported, as well as tinting tools, and spectrum tools for systems with more than three color mixing elements. Color may also be set directly to a gel match via a graphic selection tool or from the command line. The gel picker shall support tools for identifying similar colors, show favorites, and graphic indications of gel locations. The white point of fixtures may be determined in patch. Color Path tools, with intensity dampening, shall be provided
        - h. The Virtual Media Server function shall allow the user to create layouts of devices, identified as pixel maps. Media content (images, movies, text and procedurally generated effects) may then be applied, manipulated and stored. Stock content is provided and the user may import custom imagery and animations.
        - i. Macros may be set to run as default. Default macros called manually shall post to the command line, but executed via cue lists shall run in the background. The user may override this behavior by defining the macro to always execute in the foreground or the background, regardless of the recall method. Startup, Shutdown and Disconnect macros may also be defined.
- 2. Playback Section
  - a. The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons. Additional playback faders may be configured via the virtual fader module or on the Universal Fader Wings.
  - b. It shall be possible to instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade.
  - c. It shall be possible for a cue list to contribute to the background state or for the contents of each cue list to be withheld from such.
  - d. The playback faders shall have the following associate controls:
    - 1) Freeze, which halts the output of the fader
    - 2) Stop Effect, which stops the action of an effect.
    - 3) Filter, to assign filter states to a fader
    - 4) Go to Cue 0, to reset a cue list.
- 3. Fader Wings (Optional)
  - a. Submaster and fader support shall be provided via optional fader wings. These wings are available in 1x20, 2x10 and 2x20 configurations. Up to six of these wings may be connected to the desk via internal or external USB. Via paging, access is provided to all 300 faders, regardless of the number of physical wings attached.
  - b. The 2x10 and 2x20 fader wings shall include a full length LCD for labeling and identification functions. Each fader shall have two associated hard buttons for various operations. Systems without a local display or fewer than two buttons per fader shall not be acceptable.

- c. Up to 999 proportional, fully overlapping additive, effect or inhibitive submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Each has a bump and assert/channel select button. Submasters may be set to independent, exclusive, shielded and proportional/intensity or effect master control.
    - d. The submaster blind buffer shall be linked directly to live playback allowing live editing of live submaster content via the command line.
    - e. It shall be possible to set submaster values directly from the command line.
    - f. Up to 200 cue lists may be active concurrently.
  - 4. Grand Master
    - a. A dedicated grand master and blackout button are provided.
    - b. The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero, except those defined as exempt from GM control. Non-intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.
- C. Display Controls
  - 1. Format shall change the view of selected displays.
  - 2. It shall be possible for the user to choose which parameter categories or parameters (s)he wishes to display.
  - 3. Flexichannel shall change which channels are viewed in selected displays, as follows:
    - a. All channels
    - b. Patched channels
    - c. Show channels
    - d. Active/Moved channels
    - e. Selected channels
    - f. Manual Channels
    - g. View channels (user identified list)
    - h. Channels with discrete timing
  - 4. Expand shall extend the selected view sequentially across connected displays, vertically or horizontally.

5. [Time] depressed shall display discrete timing data. [Data] depressed shall display absolute values of referenced data.
6. User definable magic sheets shall provide alternative display of and access to channels and record targets. Multiple magic sheets may be created.
7. Playback status displays are provided with a variety of different formats. Indications are provided per cue for live moves (lights fading from zero and also moving non-intensity parameters) and dark moves (inactive lights which have stored non-intensity parameter moves).
8. Each display may have three individually configured workspaces. Each workspace supports discrete frame controls allowing user defined displays, sized as per user requirements.

D. Operating Modes

1. Live Mode
  - a. Channel lists may be constructed using the +, - and Thru keys as well as the direct selects. Channel selection and deselection is fully interactive, regardless of the method used.
  - b. Levels may be set with the keypad, level wheel and non-intensity encoders. "Selected" channels shall be those last addressed and under keypad control.
  - c. Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified or default times.
  - d. Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable via the command line or with a default setup value.
  - e. Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order and subgrouping functions. The Offset function supports rapid creation of ordered groups, including reverse and random order.
  - f. Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 presets and 1000 of each palette type.
  - g. Any collection of channel data, as determined by the use of "Record", "Record Only, selective store commands and/or parameter filters may be stored to palettes (as appropriate to the type) and presets.
  - h. The following conditions may be placed on a channel or channel parameter to be included with a cue record action.
    - 1) Discrete fade time and/or delay

- 2) Block flag
  - 3) Assert flag
  - 4) IFCB Filters, which may be set at a parameter level
- i. 999 cue lists may be stored. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts.
- j. It shall be possible to record cues and cue parts with the following information:
- 1) Any collection of channel data, as determined by the use of "Record", "Record Only" or selective store commands, combined with parameter filters.
  - 2) Cue Level timing and delays for Intensity Up, Intensity Down, Focus, Color and Beam.
  - 3) Follow or hang time
  - 4) Link instruction
  - 5) Loop value
  - 6) Block, Assert, Allfade, Preheat and/or Mark Flag
  - 7) Curve
  - 8) Label and note
  - 9) Execute list to trigger other activity (execute cue lists, cues, macros and snapshots). Cue list partitions shall be available to curate list content.
- k. Non-intensity channel parameters may be marked (preset), in two ways. Automark presets any parameters transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a "live" move. Alternatively, non-intensity parameters may be marked to a specific cue with a single command instruction. It shall not be necessary to store these parameters directly into the cue in which the movement is to occur.
- l. Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.
- m. Update may be used to selectively add modified parameter data quickly to that parameter's current source. It shall be possible to update inactive record targets. It shall also be possible to update back to the current source of the move instruction without specifying that cue via Trace. A context sensitive display provides detailed information regarding the results of the update command.
- n. Recall From quickly pulls specified data from record targets or other channels into the current view. Recall from on an HTP basis shall be provided.

- o. Copy To quickly copies selected data to specified channels or other record targets.
  - p. Address and channel check functions shall be provided.
  - q. Channel parameters may be "parked" at levels. Output addresses may also be parted directly. Parked levels shall not be added to any live record operations, nor may they be changed until the parked element is "unparked". Address Park shall also be provided.
  - r. About shall provide detailed status of selected channels or specified record targets. This shall include current source, current value, discrete timing, parked value, marked to and for indications. Background levels and current DMX output are also displayed. Channel usage indicates submaster and cue information and also provides a "dark moves" report on a per channel basis.
  - s. 1000 snapshots may be stored which instantly recall specified front panel and display configurations.
  - t. Live data may be displayed in a summary view, detailed table orientation or a user-defined magic sheet.
  - u. Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.
  - v. Home shall set selected channels non-intensity parameters to their default values. User definable home, on a per-channel/per-parameter basis shall be provided.
  - w. Move shall allow all show data to be moved from one record target to another.
  - x. Query shall allow selection of channels by their current or possible state. Keywords and fixture types shall allow quick access to fixtures.
2. Blind
- a. The Blind display allows viewing and modification of all record targets without affecting stage levels.
  - b. Record target data may be displayed in a summary view, a detailed table orientation or a spreadsheet view, which allows quick data comparisons, move and replace with functions.
  - c. Changes made in blind displays shall be automatically stored.
  - d. Blind editing shall be possible for all record targets.
  - e. Selection of what parameter data to view for blind editing shall be user configurable.
3. Patch Display

- a. Patch shall be used to display and modify the system control channels with their associated library data.
- b. Each channel may be provided with a proportional patch level, preheat, curve, label, white point, swap and invert functions.
- c. Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a "custom" footprint for any device output.
- d. A full library of profiles is provided, with the ability for the user to define "favorites" for fast selection.
- e. Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.
- f. Copy to and Move functions shall be supported in patch.
- g. RDM discovery and device monitoring shall be supported.

4. Setup/Browser

- a. Setup shall access system, show and desk configurations.
- b. The browser shall access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.
- c. It shall be possible to partially merge show files. Users shall be able to select as much or as little of the show file as required, with renumber tools.
- d. It shall be possible to import ASCII and Lightwright data files. It shall be possible to export as ASCII or .csv.
- e. The system shall support programming and playback of real time clock events, including cue, submaster and macro execution at specific times of specified days or at a time based on astronomical events.
- f. A control screen shall be provided for network configuration, selecting date/time, software update controls, selecting functional language and/or keyboard for labeling option, as well as other system level tools.
- g. Available languages for prompts, advisories and help messages shall include English, Bulgarian, German, Spanish, French, Italian, Japanese, Korean, Russian, Chinese, simplified and Chinese, traditional.
- h. Supported keyboards shall include American, United Kingdom, French, German, Italian, Korean, Norwegian, Russian, Slovakian, Turkish, Swiss, Swedish, Finnish and Bulgarian

E. Dimmer Monitoring and Configuration

- 1. The lighting control system shall provide communication with an ETC Sensor+, Sensor3 or FDX dimming system for remote monitoring and configuration of show specific functions from within the software application.



2. Circuit level configuration and monitoring functions shall include but not be limited to:
  - a. Control mode (dimnable, switched, latch-lock, always on, off or fluorescent).
  - b. Curves
  - c. Control threshold
  - d. Min and Max Scale Voltage
  - e. Preheat
  - f. Scale load
3. Rack Status messages shall include but not be limited to:
  - a. State of UL924 panic closure
  - b. DMX port error/failure
  - c. Network error/failure
  - d. A, B, C Phase below 90 or above 139 volts and headroom warning
  - e. Ambient temperatures out of range
4. Circuit status shall include but not be limited to:
  - a. Module type and location
  - b. Output level
  - c. Control Source
  - d. Overtemp
5. Advanced circuit feedback shall include but not be limited to:
  - a. Load higher or lower than recorded value
  - b. DC detected on output
  - c. SCR failed on/off
  - d. Breaker trip
  - e. Module has been removed
  - f. Load failure
  - g. Shutdown due to Overtemp

F. Training Options

1. Training packages shall be available customizable to the individual venue preferences and needs. The level of training (beginner, intermediate or advanced) may be selected and training may be defined as an element of system commissioning or deferred to a later time.

G. Interface Options

1. The unit shall support a variety of local interfaces.
  - a. AC input.
  - b. USB (seven ports for connecting devices such as an alphanumeric keyboard, mouse, touch screens, USB Flash drive, fader wings, etc.) The desk shall provide at least one USB port on the face panel itself.
  - c. Ethernet (two individually configurable ports)
  - d. Two DVI video output connectors, supporting a maximum of two DVI monitors at 1280x1024 resolution minimum, touchscreen and multi-touch controls optional.
  - e. One Display Port connector
  - f. Two DMX512-A/RDM Ports
  - g. Contact Closure Trigger via D-Sub Connector
  - h. MIDI In/Out (MIDI Timecode, MIDI Show Control)
  - i. OSC and UPD Transmit/Receive
  - j. XLR 3-Pin Female (Littlite)
  - k. One eSATA port

H. Accessories

1. Net3 Radio Focus Remote
2. iRFR and iRFR Preview (application for iPhone, iPod Touch and iPad units)
3. aRFR (application for Android devices)
4. Net3 Remote Video Interface
5. Up to six fader wings may be attached to the main console via internal or external USB connections.
6. Net 3Gateways
  - a. Net3/ETCNet 2 to DMX/RDM Gateways (one to four ports)
  - b. MIDI/SMPTE Gateways

- c. I/O Gateway with 12 analog inputs, 12 SPDT contact outputs, RD232 interface
  - 7. ETCnomad Software (Mirror Mode)
  - 8. ETCnomad Kit (client or backup)
- I. Synchronized Backup
  - 1. An optional Backup system shall consist of one of the following combinations of devices:
    - a. Two networked desks
    - b. One (or more) desk with one Remote Processor Unit (RPU)
    - c. One (or more) desk with two Remote Processor Units (RPUs)
    - d. One (or more) desks/RPUs with ETCnomad
- J. Physical and Acoustical
  - 1. All operator controls and electronics for a standard system shall be housed in a single desktop console, not to exceed 19" wide, 19" deep, 5.5" high, weighing 20 pounds.
  - 2. Power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.
  - 3. At typical CPU utilization, the unit shall operate at  $\leq 26$  dBA.

## **2.8 RELAY MODULES**

### **A. General**

- 1. The Relay modules shall be the ETC Relay modules as manufactured by Electronic Theatre Controls, Inc., or equal. The relay modules shall be designed for dependable, economical service in theatrical, architectural, and video applications for use with theatrical and architectural lighting and motorized equipment.
  - a. Relay modules shall be compatible with both Sensor Dimming Systems and Unison Dimming Systems
- 2. Relay module configuration shall be dual channel, 100/140V, 15A or 20A, as noted on the Electrical Drawings.
- 3. Relay modules shall be fully plug-in and factory wired. The modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the

manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Relay modules shall be UL and cUL listed power control devices with a minimum AIC rating of 10,000A.

4. Modules shall have a fully magnetic circuit breaker for each channel. Relay modules shall be rated for a minimum of 100,000 full load activations.
5. Modules shall have Signal and Load LED indicators for each channel.
6. Relay modules shall be available with ETC Advanced Features providing load and status information.

## 2.9 RELAY MODULES

### A. Mechanical

1. ETC relay modules shall be designed for use with Unison or Sensor dimming racks.
2. Dimmer modules shall consist of a heavy-duty, die-cast aluminum chassis with an integral faceplate. All parts shall be properly treated, primed and finished in fine-texture, scratch-resistant gray epoxy powder coat.
3. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable.
4. With the exception of the circuit breaker, the module shall contain no moving parts.
5. Each module shall be labeled with the manufacturer's name, catalog number and rating.
6. All electronic components (current/voltage sensors and indicators) shall be contained in a single field-replaceable housing.

### B. Electrical

1. Each dimmer shall consist of the following components:
  - a. One or two single-pole circuit breakers
    - 1) Circuit breakers shall be fully magnetic so the trip current is not affected by ambient temperature.
    - 2) Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current.
    - 3) Circuit breakers shall be rated for 100 percent switching duty applications.
  - b. Power and control connectors.
    - 1) Modules shall not have any protruding pins subject to physical damage when the module is not installed.
    - 2) Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS.
    - 3) The relay shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.
    - 4) Relay modules shall be UL and cUL(120V, 240V and 277V listed) or CE marked (230V) power control devices with Standard SCCR fault current protection shall be 100,000 Amps at 120V and 24,000 Amps at 230V, 240V and 277V.

## 2.10 COLOR MIXING OR WHITE-LIGHT LIGHT EMITTING DIODE PROFILE FIXTURE

### A. General

1. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a Source Four LED series 3 as manufactured by Electronics Theatre Controls, Inc. or approved equal.
2. All LED fixtures shall be provided by a single manufacturer to ensure compatibility
3. The fixture shall be UL 1573 listed for stage and studio use
4. The fixture shall comply with the USITT DMX-512A standard

### B. Physical

1. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black.
2. The following shall be provided:
  - a. Lens secured with silicone shock mounts
  - b. Shutter assembly shall allow for  $\pm 25^\circ$  rotation
  - c. 20 gauge stainless steel shutters
  - d. Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement
  - e. Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer
  - f. Rugged steel yoke with two mounting positions allowing  $300^\circ+$  rotation of the fixture within the yoke
  - g. Positive locking, hand operated yoke clutch
  - h. Slot with sliding cover for motorized pattern devices or optional iris
3. The housing shall have a rugged black powder coat finish
  - a. White or silver/gray powder coat finishes shall be available as color options
  - b. Other powder coat color options shall be available on request
4. Power supply, cooling and electronics shall be integral to each unit.
5. The unit shall ship with
  - a. Theatrical-style hanging yoke as standard
  - b. 5' Neutrik PowerCon™ to Edison power cable as standard
  - c. Gate diffuser
  - d. A-size pattern holder
6. Available options shall include but not be limited to:
  - a. Bare-end, Stage-Pin or Twist-lock type-equipped power leads
  - b. PowerCon to PowerCon cables for fixture power linking
  - c. Smooth Wash Diffuser for overlapping beams of light from multiple fixtures

### C. Optical

1. The light beam should have a 2-to-1 center-to-edge drop-off ratio
2. The unit shall provide, but not be limited to:

- a. Low gate and beam temperature
    - b. Sharp imaging through a three-plane shutter design
  - 3. The unit shall provide, but not be limited to:
    - a. 5, 10, 14, 19, 26, 36, 50, 70 and 90 degree field angles
    - b. High-quality pattern imaging
    - c. Sharp shutter cuts without halation
    - d. Shutter warping and burnout in normal use shall be unacceptable
    - e. Adjustable hard and soft beam edges
  - 4. 19, 26, 36, and 50 degree units shall have optional lens tubes available for precision, high-contrast imaging.
- D. Environmental and Agency Compliance
- 1. The fixture shall be ETL and cETL LISTED and/or CE rated, and shall be so labeled when delivered to the job site.
  - 2. The fixture shall be ETL LISTED to the UL1573 standard for stage and studio use
  - 3. The fixture shall be rated for IP-20 dry location use.
- E. Thermal
- 1. Fixture shall be equipped with a cooling fan.
    - a. Fan speed control via a DMX channel shall be possible
    - b. Fan speed software shall permit the fixture to override DMX fan speed setting to prevent heat damage to the fixture
  - 2. The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 20,000 hours of use
    - a. Thermal management shall include multiple temperature sensors within the housing to include:
      - 1) LED array circuit board temperatures
      - 2) Temperature sensors placed on each individual LED color circuit
      - 3) Fixture ambient
      - 4) CPU
    - b. Fixture user shall permit monitoring of temperature sensors via a legible LCD multi-line backlit display
    - c. Fixtures that do not provide active thermal monitoring of LED circuits and other temperature readings shall not be acceptable
  - 3. The fixture shall operate in an ambient temperature range of 0°C (32°F) minimum, to 40° C (104°F) maximum ambient temperature.
- F. Electrical
- 1. The fixture shall be equipped with a 100V to 240V 50/60Hz internal power supply
  - 2. The fixture shall support power in and thru operation

- a. Power in shall be via Neutrik® PowerCon™ input connector
  - b. Power thru shall be via Neutrik® PowerCon™ output connector
  - c. Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker
3. The fixture requires power from a non-dim source
4. Power supply outputs shall have self-resetting current-limiting protection
5. Power supply shall have power factor correction

G. LED Emitters

1. The fixture shall contain a minimum of five different LED colors to provide color characteristics as described in the Color Section below
2. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
  - a. Fixture shall utilize Luxeon® Rebel™ LED emitters
3. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
4. LED emitters should be rated for nominal 20,000-hour LED life to 70% intensity
5. All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.
6. LED system shall comply with all relevant patents

H. Calibration

1. Fixture shall be calibrated at factory for achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins
  - a. Calibration data shall be stored on the LED array as a permanent part of on-board operating system
  - b. All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency
  - c. Fixtures not offering LED calibration shall not be acceptable

I. Color

1. The fixture shall utilize a minimum of 60 LED emitters
2. The fixture shall be available in specialized LED arrays as outlined below:
  - a. Source Four LED Series 2 Lustr
    - 1) Red, Amber, Green, Cyan, Blue, Indigo and Lime LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr array as manufactured by Electronic Theatre Controls, or approved equal
      - a) Measured brightness of the Lustr array shall be greater than 6,500 field lumens

J. Dimming

1. The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming.
2. At least four different dimming curve options shall be accessible at the fixture' s User Interface
  - a. Incandescent
  - b. Standard
  - c. Linear
  - d. Quick
3. Dimming curves shall be optimized for smooth dimming over longer timed fades.
4. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
5. LED control shall be compatible with broadcast equipment in the following ways:
  - a. PWM control of LED levels shall be imperceptible to video cameras and related equipment
  - b. PWM rates shall be adjustable by the user at the fixture if necessary to avoid any visible interference to video cameras and related equipment

K. Control and User interface

1. The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors
2. The fixture shall be compatible with the ANSI RDM E1.20 standard
  - a. All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console
  - b. Temperature sensors within the luminaire shall be viewable in real time via RDM
  - c. Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible
3. The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes
4. The fixture shall be equipped with a six-button user-interface
5. The fixture shall offer multiple DMX input profile options to include:
  - a. RGB - control of all individual LED colors via a three-channel profile
    - 1) Red, Green, Blue
  - b. HSI – control of all individual LED colors via a three-channel profile
    - 1) Hue, Saturation, Intensity
  - c. HSIC – control of all LED colors via a four-channel profile
    - 1) Hue, Saturation, Intensity and Color Point
      - a) Color point provides variable color temperature settings
  - d. Direct – control of each individual color channel via an independent channel
  - e. Studio – Control of the fixture in a white-light 3 channel profile
    - 1) Intensity, Color Temperature, +/- Green (Tint)



- a) Without DMX the fixture can master other Source Four LEDs and Desire fixtures that are connected via 5 pin XLR DMX cables
  - f. A variable-rate strobe channel shall be provided
- 6. The fixture shall offer three output settings
  - a. Boost mode - powers LEDs at maximum intensity and provides no compensation against LED droop' or intensity loss
  - b. Regulated mode – slightly restricts maximum LED intensity levels to compensate against LED droop
  - c. Protected mode – further restricts maximum LED intensity levels to compensate against LED droop and offer color consistency at highest permissible ambient temperatures (40C)
  - d. Fixtures that do not provide regulated and protected operation modes are not acceptable
- 7. The fixture shall offer additional user-definable options to including but not limited to
  - a. Display time out options
  - b. Loss of data behavior options
  - c. White point settings
  - d. Red-shift option for tungsten dimming emulation
- 8. The fixture shall offer five Quick Set-Ups to allow user to rapidly select different combinations of the numerous user options based on the desired usage situation, to include:
  - a. General – for most situations
  - b. Stage – when emulating incandescent fixtures is desired
  - c. High Impact – when maximum output and effect is desired
  - d. XT Arch – when color consistency and architectural characteristics are desired.
  - e. Studio - when DMX or stand-alone of white light output is required with intensity, color temperature and color tint control parameters
- 9. The fixture shall offer stand-alone functionality eliminating the need for a console
  - a. Fixture shall ship with 24 preset colors accessible as a stand-alone feature
  - b. Fixture shall ship with 12 sequences accessible as a stand-alone feature
  - c. Each color and sequence can be modified by the end user
  - d. Fixtures can be linked together with standard DMX cables and controlled from designated master fixture
    - 1) Up to 32 fixtures may be linked
  - e. Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming
  - f. Fixtures without stand-alone operation features described above shall not be acceptable
- 10. The fixture shall be capable of copying all performance settings to other fixtures of the same type via a 5 pin XLR DMX cable

## 2.11 DMX ETHERNET GATEWAY – ONEPORT

### A. General

1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512. The unit shall be a Net3 DMX 1-port Gateway as provided by ETC, Inc.
2. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
3. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The gateway shall support multiple protocols including:
  - a. ANSI E1.31 Streaming ACN (sACN)
  - b. ANSI E1.11 USITT DMX512-A
  - c. ETCNet2 protocol suite
  - d. ETCNet protocol suite
5. The gateway shall be tested to UL standards and labeled ETL Listed.
6. The gateway shall be RoHS Compliant (lead-free).
7. The gateway shall be CE compliant.
8. The gateway shall be configurable using Network Configuration Editor (NCE) software.
9. Each gateway shall have power and network activity LEDs

### B. DMX Ports

1. DMX Port shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
2. The DMX port shall be software-configurable for either input or output functionality.
3. Hardware configuration override setting shall be provided on the gateway.
4. DMX input shall be optically-isolated from the gateway electronics.
5. DMX output shall be earth-ground referenced.
6. DMX Port shall be capable of withstanding fault voltages of up to 250vAC without damage.
7. Each port shall incorporate one DMX512-A Connection
  - a. Each DMX port location shall support a single 5-pin male XLR or 5-pin female XLR
8. Network gateways that do not indicate input/ output port configuration or presence of valid data shall not be accepted

### C. Processor

1. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 mSec.).
2. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility with 3rd party DMX devices.

### D. Mechanical

1. The gateway faceplate shall be constructed of durable cast aluminum and mount in a standard 1 gang backbox. Faceplates manufactured of plastic shall not be acceptable.
2. Gateways shall be provided in matte black powder coat finish.
3. The gateway shall be available in two versions
  - a. Wall mount gateway
    - 1) The wall mount gateway shall support flush or surface mount applications using a standard RACO 690 backbox or equivalent.
    - 2) Dimensions shall not be more than 2.75" (70mm) wide x 4.5" (115mm) High
    - 3) Wall mount gateways shall not weigh more than .35 lbs (.16kgs)
  - b. Touring gateway
    - 1) The touring gateway shall include a complete enclosure with Ethercon and power connectors for wiring terminations
    - 2) Dimensions shall not be more than 4.5" wide (115mm) x 3.5" (89mm) deep x 6.34" (161mm) high (not including mounting hardware)
    - 3) Touring gateways shall not weigh more than 2.5 lbs (1.1 kg).

E. Power

1. Power for the gateway shall be provided either over the Category 5 (or better) cable, utilizing IEEE 802.3af compliant Power over Ethernet distribution equipment. Power consumption shall not be greater than 5 watts.
2. The gateway electronics shall be electrically isolated from the power supplied over the Catagory5 (or better) cable.
3. Power may be provided from any IEEE 802.3af compliant power-over Ethernet distribution equipment, or by using conventional switches together with isolated in-line power supplies as provided by gateway manufacturer.

F. Configuration

1. Each gateway on the network shall be individually configurable using Network Configuration Editor (NCE), running on a network connected PC. The PC shall only be required for configuration, and shall not be required for normal operation of the system.
2. Each DMX gateway shall control up to 512 DMX addresses. The specific DMX data input or output by the gateway shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
3. Multiple sACN sources may be combined with a priority may be assigned to each source sending data to the gateway.

G. Network

1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.
2. All network cabling shall be Category 5 (or better), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ANSI E1.31 streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.31 shall not be acceptable.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.

6. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 63,399 universes (32,767,488 addresses) when using Streaming ACN (sACN) and 64 DMX universes (32,767 addresses) when using EDMX.
  - a. Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.
  - b. Each DMX port shall support its own universe and start address.
7. Gateways shall support built in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent channel priorities shall not be accepted.

H. Environmental

1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
3. The operating humidity shall be 5% - 95% non-condensing.

I. Accessories

1. Hanging bracket kit shall allow gateway to be mounted using C-Clamp to U-bolt Hardware.
2. ETC Network Configuration Editor (NCE) software

J. System Requirements

1. Provide the quantity and type of gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theatre Controls Inc. of Middleton, WI.
2. Provide Ethernet switches and power supplies as scheduled and as shown on drawings.
3. Provide a current generation PC with Windows XP operating system equipped with a 10/100 Ethernet card.
4. Systems that do not provide the above capabilities shall not be acceptable

## 2.12 GENERAL NETWORK

A. General

1. The Electronic Theatre Controls Net3 network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.
2. Connections shall be made between consoles, face panels, architectural processors, dimmers, Net3 Gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to established Ethernet wiring practice, and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.
3. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. Capacities

1. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.
2. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall support multiple venues within a system and discrete systems on the same network.

C. System Configuration and Monitoring

1. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software and/or ANSI E1.17 Architecture for Control Networks (ACN).
2. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.
  - a. The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.
  - b. The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.
  - c. The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.
  - d. Lighting systems that do not support the above mentioned address patching capabilities shall not be suitable.
3. The system shall allow assignable labels for all network devices to allow easy identification by system users.
4. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that do not support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above mentioned features over ANSI E1.17 ACN shall not be acceptable.
5. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.
6. Lighting console operators shall be able to backup the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that do not support configuration backup as described above shall not be accepted.
7. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.

8. The Net3 network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multi-source control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.
9. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manner. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP for DMX inputs to the network shall not be allowed.

D. Operational Features

1. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 address). The specific DMX data input or output by the gateway shall be configurable by the user.
2. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.
3. Merging of multiple DMX input sources on a single gateway without gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently
4. File transmission, synchronization and access to software shall be supported.

**2.13 ENHANCED DEFINITION LENS TUBES**

- A. The product shall be an optional fixed focus lens tube with a field angle of (19° - 26° - 36° - 50°) for use with a Source Four ERS fixture body. When used as a template or gobo projector, the product shall provide enhanced image acuity, heightened contrast and minimum distortion when compared to any other fixed focus ERS fixtures.
- B. The product shall result in no loss of field lumens when compared to standard fixed focus fixtures.
- C. The product shall be retrofit-able into any new or existing Source Four ERS fixture body. The product shall be available as an accessory and not require the purchase of an entire fixture.
- D. The product shall be labeled in such a way as to easily distinguish it from standard lens tubes. The product shall not be labeled or marked in such a way as to be garish or distracting when placed in a system with other fixtures.
- E. The product shall be available in black standard with silver, white and custom colors as options.

**2.14 WIRE AND CABLE**

- A. Building Wire in Raceways: Comply with requirements specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

- B. Portable Power Cable: Listed and labeled by an NRTL; flexible stage and lighting power cable; Type SC, SCE, or SCT; 600 V; multiconductor; 60 deg C temperature rating.
- C. Ethernet Cabling: Comply with requirements specified in Section 260523 "Control-Voltage Electrical Power Cables."
  - 1. For 10/100BaseT, comply with provisions for UTP cable and hardware.
  - 2. For 10Base-FL, comply with provisions for 62.5/125-micrometer, multimode, optical-fiber cable and hardware.
- D. ANSI E1.11 (USITT DMX512-A) Control Cabling: Comply with requirements specified in Section 260523 "Control-Voltage Electrical Power Cables."
  - 1. Standard Cable: NFPA 70, Type CM.
    - a. Paired, low-capacitance computer cable for ANSI E1.11 (USITT DMX512-A) applications. Two pairs, twisted, No. 22 AWG, stranded, tinned-copper conductors.
    - b. PE insulation.
    - c. Inner Shield: 100 percent coverage, aluminum foil-polyester tape.
    - d. Outer Shield: 90 percent coverage, tinned-copper braid.
    - e. Outer Shield Drain Wire: Stranded, tinned copper.
    - f. PVC jacket.
    - g. Flame Resistance: Comply with UL 1581.
- E. Control-Voltage Control Cabling:
  - 1. Control-Cable Conductors:
    - a. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway; complying with UL 83.
    - b. Class 1 Control Circuits: Stranded copper, Type THHN, in raceway; complying with UL 44.
    - c. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway; complying with UL 83.
    - d. Class 2 Control Circuits: Stranded copper, Type THHN, in raceway; complying with UL 44.
    - e. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF; complying with UL 83.
  - 2. Paired Cable: NFPA 70, Type CMG.
    - a. One pair, twisted, No. 16 AWG, stranded, tinned-copper conductors.
    - b. PVC insulation.
    - c. Unshielded.
    - d. PVC jacket.
    - e. Flame Resistance: Comply with UL 1581.
  - 3. Paired Cable: NFPA 70, Type CMG.
    - a. One pair, twisted, No. 18 AWG, stranded (19x30), tinned-copper conductors.
    - b. PVC insulation.
    - c. Unshielded.
    - d. PVC jacket.

- e. Flame Resistance: Comply with UL 1581.

## **PART 3 - EXECUTION**

### **3.1 SUPPLY**

- A. Supply of theatrical lighting control equipment, infrastructures and fixtures:
  - 1. Electrical Contractor (EC) shall purchase all theatrical lighting system components, fixtures, accessories as specified from the Theatrical Dealer/Integrator (Integrator) selected by the EC. ELECTRICAL DISTRIBUTORS SHALL NOT SUPPLY THESE ITEMS TO EC. This requirement will ensure the involvement of entities who are application-familiar and qualified to facilitate a smooth and successful installation for the Owner.
  - 2. Other electrical equipment and ancillary componentry (pipe, wire, fittings, etcetera...) shall be supplied by the EC.
  - 3. Installation of all components shall be the responsibility of the EC.

### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Set permanently mounted items level, plumb, and square with ceilings and walls.
- C. Indicated mounting heights are to bottom of unit for suspended items and to center of unit for wall-mounted items.
- D. Mount and connect luminaires and install and connect distribution devices.
  - 1. If arrangement is not indicated, install so each luminaire, dimmer, house lighting circuit, control channel, and outlet circuit can be operated, and complete system demonstrated, in all operating modes.
  - 2. Install safety cables secured to stage rigging or gridiron for all pipe-mounted electrical luminaires and equipment.
- E. Integration of Theatrical Lighting Control Equipment:
  - 1. Integrator shall coordinate with the EC the proper installation of a complete stage lighting and dimming system, components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.
- F. Integrator's verification of electrical contractor's installation:
  - 1. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.



2. Assist the EC to identify any malfunctioning components onsite. Retest to demonstrate compliance; coordinate the removal and replacement of faulty components and proceed with retesting.

G. Services rendered by integrator to electrician:

1. Integrator shall supply the following services to the EC:
  - a. Attendance at prebid walkthrough(s) to answer questions about theatrical lighting systems.
  - b. All theatrical lighting system documentation, submittals etcetera.
  - c. Regular coordination with EC throughout full term of project.
  - d. Review all theatrical low voltage terminations made by the EC.
    - 1) Integrator may offer and provide low voltage data terminations as an added service.
  - e. Review the complete theatrical system(s) prior to energization and supervise the energization of system.
  - f. Complete programming of the system including all button stations and touchscreens and to ensure all architectural fixtures are dimming smoothly and flicker free (within the reasonable and physical capabilities of the fixtures and system.)
    - 1) Two additional site visits shall be provided after the building has been turned over, at six months and one year, to make any changes to the programming that may be required by the Owner.
  - g. Theatrical fixture assembly and bench focus prior to hang.
    - 1) Applicable to portable theatrical fixtures only. Assembly and installation of permanent architectural fixtures are the responsibility of the EC.
  - h. Initial hang and focus of portable theatrical fixtures per engineer's/owner's requirements – if applicable.
  - i. Develop and apply DMX addressing scheme applicable to system scope.
    - 1) Perform initial DMX addressing of all fixtures (theatrical and architectural) connected to the theatrical lighting system.
    - 2) Verify that all system-connected fixtures respond to system-sourced DMX and are fully functional. Verify RDM communication/capabilities for all DMX/RDM fixtures as applicable.
    - 3) Document all DMX & RDM settings at time of system turnover. Deliver said documentation to EC for inclusion in the closeout O&M packet.
  - j. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.
  - k. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work. EC shall be on site as required, to adjust lighting control units for proper light levels as directed by engineer.

- l. Provide all required drawings for each system identified; show all hardware configurations, panel required schedules and numbering. All panel wiring diagrams and typical wiring diagrams for each component.
- m. Provide as-built/redlined drawings upon completion of the theatrical lighting system to the EC for inclusion in the closeout O&M packet.

### **3.3 WIRING**

- A. Power Wiring:
  - 1. Install wiring as specified in Section 26 0120, "Conductors and Cables" for hardwired connections. Install wiring in raceways except cable and plug connections. Install cable strain relief device on power and control cable drops.
  - 2. Install power wiring with a separate neutral for each output circuit from main dimmer and for each house and stage lighting circuit.
- B. Signaling, Remote-Control, and Power-Limited Circuits:
  - 1. Install wiring in raceways except cable and plug connections.
  - 2. Comply with the following unless otherwise indicated:
    - a. Size conductors according to lighting control device manufacturer's written instructions.
    - b. Select cable insulation, shielding, drain wire, and jacket complying with lighting control device manufacturer's written instructions.
    - c. Install circuits to eliminate RFI and electromagnetic interference.
  - 3. Remote-control circuits associated with emergency lighting control shall be installed complying with Class 1 circuit standards in NFPA 70.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes and in terminal cabinets and equipment enclosures.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Support luminaires, distribution components, and accessories as specified in Section 260529 "Hangers and Supports for Electrical Systems." Equip all pipe-mounted equipment with safety cables that are secured to supporting pipe.
- G. Ground equipment according to Section 26 0452 "Grounding."

### **3.4 IDENTIFICATION**

- A. Label each luminaire, lighting outlet, distribution device, and dimmer module with unique designation. Labels on elevated components shall be readable from the floor.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, inspect, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
  - 2. Visual and Mechanical Tests and Inspections:
    - a. Inspect each luminaire, outlet, module, control, and device for defects, finish failure, corrosion, physical damage, labeling by an NRTL, and nameplate.
    - b. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's written instructions.
    - c. Check tightness of electrical connections with torque wrench.
    - d. Verify proper protective device settings, fuse types, and ratings.
    - e. Record results of tests and inspections.
  - 3. Electrical Tests: Perform tests according to manufacturer's written instructions.
    - a. Continuity tests of circuits.
    - b. Operational Tests: Connect each outlet to a luminaire and a dimmer output circuit, so each dimmer module, dimmer-control and output circuit, outlet, and luminaire in a typical operating mode will be sequentially tested. Set and operate controls to demonstrate luminaires, outlets, dimmers, and controls in a sequence that cues and reproduces actual operating functions for a typical system of the size and scope installed. Include operation and control of houselights and stage lights from each control location and station, including optional plug-in, control-console outlet locations. Record luminaire and outlet assignments, control settings, operations, cues, and observations of performance.
- C. Stage lighting will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
  - 1. Prepare a schedule of lighting outlets by number; indicate circuits, dimmers, connected luminaires, and control-channel assignments. Prepare a schedule of control settings and circuit assignments for house control channels. Prepare written reports of tests and observations. Report defective materials, workmanship, and unsatisfactory test results. Include records of repairs and adjustments made.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- B. Modify the software programming as required to comply with the Contract Documents.

### **3.7 SOFTWARE SERVICE AGREEMENT**

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

### **3.8 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's staff in procedures for startup, testing and operating lighting control system equipment. Provide video recorded training for Owner's use.
  - 1. Training shall be one four-hour session and shall include the following:
    - a. Basic training on theatrical consoles if applicable.
    - b. Basic training on operation and configuration of theatrical LED fixtures.
  - 2. Include costs associated with the training with the equipment installation.
  - 3. Provide a 14-day notice to Owner prior to scheduling training period.

**END OF SECTION 26 5561**