

# PROJECT MANUAL CONTRACTUAL-LEGAL REQUIREMENTS SPECIFICATIONS

BAKERSFIELD CITY SCHOOL DISTRICT  
MUNSEY ELEMENTARY SCHOOL  
HVAC REPLACEMENT  
3801 BRAVE AVENUE  
BAKERSVILLE, CA 93309



Project No. 5524 Set No. \_\_\_\_\_

**CURTIS FLYNN**  
Project Architect

IDENTIFICATION STAMP  
DIV. OF THE STATE ARCHITECT

APP: 03-122489 INC:

REVIEWED FOR

SS  FLS  ACS

DATE: 07/27/2023

Integrated Designs by SOMAM, Inc.  
6011 N. Fresno Street, Suite 130  
Fresno, California 93710

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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. Access to site.
  - 4. Work restrictions.
  - 5. Specification and drawing conventions.
  - 6. Miscellaneous provisions.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: BCUSD Munsey Elementary School – HVAC Replacement
  - 1. Project Location: 3801 Brave Ave Bakersfield, CA 93309
- B. Owner: Farmersville School District.
  - 1. Owner's Representative: Mark Luque, Superintendent  
1300 Baker St, Bakersfield, CA 93305  
(661)631-4600
- C. Architect: Integrated Designs by SOMAM, Inc.  
Curtis Flynn, Project Architect  
6011 N. Fresno Street, Suite 130, Fresno, CA 93710  
(559) 436-0881
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
  - 1. Structural Engineer: Dustin Lee  
Cornerstone Structural Engineering Group  
986 W Alluvial, STE 201 Fresno, CA 93711  
(559) 320-3200
  - 2. Mechanical Engineer: Lisa Lum, Integrated Designs by SOMAM, Inc.  
6011 N. Fresno Street, Suite 130, Fresno, CA 93710  
(559) 436-0881

4. Electrical Engineer: Steve Eastham, PE  
Rose-Singh-Eastham & Assoc  
131 S Dunworth St. Visalia, CA 93292  
(559) 733-2671 ext 101

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Remove and dispose of existing unit ventilators, related piping, controls, outside air louvers and appurtenances.
  2. Remove and dispose of all mechanical equipment from the existing central plant.
  3. Patch all affected wall, roof and ceiling surfaces to match existing adjacent materials, texture and color.
- B. Type of Contract:
1. Project will be constructed under a single prime contract.

#### 1.5 ACCESS TO SITE

- A. General: 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. 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. Limits: Confine construction operations to areas indicated on the site plan.
  2. Driveways, Walkways and Entrances: Keep driveways loading areas, 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 storage of materials.
    - a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

#### 1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated.
1. Weekend Hours: Same as for weekday hours.
  2. Early Morning Hours: Coordinate with the city of Farmersville when specific times are required to perform specialty work.
  3. Hours for Utility Shutdowns: Coordinate with Farmersville Unified School District when specific times are required to perform specialty work.

4. Hours for any noisy activity: Coordinate with Farmersville Unified School District when specific times are required to perform specialty work.
- C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- D. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- E. 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.

## 1.7 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. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. 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 published as part of the U.S. National CAD Standard and scheduled on Drawings.

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

#### 1.4 ACTION SUBMITTALS

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

- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- 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.

B. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Requests for substitutions for projects under DSA jurisdiction must be approved by DSA by means of CCD submitted to DSA by the Design Professional in General Responsible Charge prior to fabrication or use in the project. All risks, including delay, due to the Division of the State Architect shall be on the party requesting the substitution. Acceptance will be in the form of a Change Order.

## 1.5 QUALITY ASSURANCE

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

## 1.6 PROCEDURES

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

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 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: Architect will consider requests for substitution if received within 30 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.
- C. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities' not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- D. Substitution shall be considered as a Change Order and, where applicable, shall be approved by DSA/OIR by means of a CCD prior to fabrication or use. All risks, including delay, due to the Division of the State Architect or other Governing Agencies shall be on a party requesting substitution.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

**SUBSTITUTION REQUEST**

**TO:** Integrated Designs by SOMAM, Inc.  
6011 N. Fresno Street, Suite 130  
Fresno, California 93710

**PROJECT:** 5281 AQUATICS CENTER FARMERSVILLE HIGH SCHOOL

**SPECIFIED ITEM:**

Section	Page	Paragraph	Description
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The undersigned requests consideration of the following:

**PROPOSED SUBSTITUTION:**

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Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution, including unforeseen conditions that are not apparent at the time of approval.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by:

Signature: \_\_\_\_\_ For use by the Design Consultant

Firm: \_\_\_\_\_  Approved Noted  Approved as

Address: \_\_\_\_\_  Not Approved  Received too late

\_\_\_\_\_ By: \_\_\_\_\_  
\_\_\_\_\_

Date: \_\_\_\_\_ Date: \_\_\_\_\_  
\_\_\_\_\_

Telephone \_\_\_\_\_ Remarks:  
\_\_\_\_\_

Attachments \_\_\_\_\_

**CONTRACTOR CERTIFICATION**

We hereby certify we have reviewed the substitution proposed and it is equivalent or better than specified products in every aspect as required by the Contract Documents.

We hereby waive our rights for additional payment and time that may become necessary because of failure of the products to perform adequately.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Date: \_\_\_\_\_

Telephone: \_\_\_\_\_

## 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 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. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than ten days after Notice to Proceed.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.

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

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the 25<sup>th</sup> of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
  - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. 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.
- E. 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.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
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. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Submittal schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. List of Contractor's principal consultants.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.
  12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
  14. Data needed to acquire Owner's insurance.
- I. 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.
  2. This application shall reflect Certificate of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.

8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

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. Requests for Information (RFIs).
3. Project meetings.

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

#### 1.4 INFORMATIONAL SUBMITTALS

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

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
  - 1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

## 1.5 GENERAL COORDINATION PROCEDURES

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

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI.
  - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Use Contractors standard RFI form.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Architect.
  - 4. RFI number including RFIs that were returned without action or withdrawn.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
  
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
  
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
  - 1. Conduct the conference to review responsibilities and personnel assignments.
  - 2. 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.
  - 3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Critical work sequencing and long-lead items.
    - c. Designation of key personnel and their duties.
    - d. Lines of communications.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.

- k. Preparation of record documents.
  - l. Use of the premises.
  - m. Work restrictions.
  - n. Working hours.
  - o. Owner's occupancy requirements.
  - p. Responsibility for temporary facilities and controls.
  - q. Procedures for moisture and mold control.
  - r. Procedures for disruptions and shutdowns.
  - s. Construction waste management and recycling.
  - t. Parking availability.
  - u. Office, work, and storage areas.
  - v. Equipment deliveries and priorities.
  - w. First aid.
  - x. Security.
  - y. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 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. Possible conflicts.
    - i. Compatibility requirements.
    - j. Time schedules.
    - k. Weather limitations.
    - l. Manufacturer's written instructions.
    - m. Warranty requirements.
    - n. Compatibility of materials.
    - o. Acceptability of substrates.
    - p. Temporary facilities and controls.
    - q. Space and access limitations.
    - r. Regulations of authorities having jurisdiction.
    - s. Testing and inspecting requirements.
    - t. Installation procedures.
    - u. Coordination with other work.
    - v. Required performance results.
    - w. Protection of adjacent work.
    - x. 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of record documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Submittal of written warranties.
    - d. Requirements for preparing operations and maintenance data.
    - e. Requirements for delivery of material samples, attic stock, and spare parts.
    - f. Requirements for demonstration and training.
    - g. Preparation of Contractor's punch list.
    - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - i. Submittal procedures.
    - j. Owner's partial occupancy requirements.
    - k. Installation of Owner's furniture, fixtures, and equipment.
    - l. Responsibility for removing temporary facilities and controls.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. 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) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Progress cleaning.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Status of RFIs.
    - 14) Status of proposal requests.
    - 15) Pending changes.
    - 16) Status of Change Orders.
    - 17) Pending claims and disputes.
    - 18) 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.

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. Contractor's construction schedule.
  - 2. Construction schedule updating reports.
  - 3. Daily construction reports.
  - 4. Material location reports.
  - 5. Site condition reports.
  - 6. Special reports.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
  - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

#### 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. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- C. Event: The starting or ending point of an activity.
- D. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time 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.

- E. Resource Loading: The allocation of manpower and equipment necessary for the completion of 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, where indicated.
  - 2. PDF electronic file.
- B. Startup construction schedule.
  - 1. Approval 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.
- 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 all 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 all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all 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. Special Reports: Submit at time of unusual event.

#### 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.

## 1.6 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial 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.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 3. 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.
  - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  - 5. 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.
  - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  - 2. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Uninterruptible services.
    - b. Use of premises restrictions.
    - c. Seasonal variations.
    - d. Environmental control.

- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. 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.
- F. 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 Contract Time.
- G. 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, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

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

## 2.3 REPORTS

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

7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (see special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Emergency procedures.
  12. Orders and requests of authorities having jurisdiction.
  13. Change Orders received and implemented.
  14. Construction Change Directives received and implemented.
  15. Services connected and disconnected.
  16. Equipment or system tests and startups.
- B. Material Location Reports: At monthly 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.

## 2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: 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, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

END OF SECTION 013200

## 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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 5. 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."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

## 1.4 ACTION SUBMITTALS

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

## 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 10 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 14 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 10 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
  1. Indicate name of firm or entity that prepared each submittal on label or title block.
  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. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
  - j. Number and title of appropriate Specification Section.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
  
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
  - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Destination (To:).
    - 4) Source (From:).
    - 5) Name and address of Architect.
    - 6) Name of Contractor.
    - 7) Name of firm or entity that prepared submittal.
    - 8) Names of subcontractor, manufacturer, and supplier.
    - 9) Category and type of submittal.
    - 10) Submittal purpose and description.
    - 11) Specification Section number and title.
    - 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
    - 13) Drawing number and detail references, as appropriate.
    - 14) Indication of full or partial submittal.
    - 15) Transmittal number, numbered consecutively.
    - 16) Submittal and transmittal distribution record.
    - 17) Remarks.
    - 18) Signature of transmitter.
  
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., CES-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., CES-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.

- c. Name and address of Architect.
  - d. Name of Contractor.
  - e. Name of firm or entity that prepared submittal.
  - f. Names of subcontractor, manufacturer, and supplier.
  - g. Category and type of submittal.
  - h. Submittal purpose and description.
  - i. Specification Section number and title.
  - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Related physical samples submitted directly.
  - n. Indication of full or partial submittal.
  - o. Transmittal number, numbered consecutively.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
  - b. Number and title of appropriate Specification Section.
  - c. Manufacturer name.
  - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. 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.
- I. 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.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  2. Submit electronic submittals via email as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
  4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
  5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.

- b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: 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. 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.
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  - 2. Manufacturer and product name, and model number if applicable.
  - 3. Number and name of room or space.
  - 4. Location within room or space.
  - 5. Submit product schedule in the following format:
    - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

- J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. 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:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- T. 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.

- U. 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 primers and substrate preparation needed for adhesion.
- V. 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.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 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 Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three 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.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
  - 1. Reviewed: Submittal is deemed acceptable for products, materials, equipment to be incorporated into the construction.
  - 2. Revise and Resubmit: Revise submittal per architects/engineers review comments and resubmit for additional review.
  - 3. Furnish as Corrected: Provide materials, equipment as noted on submittal, no further submission is required.
  - 4. Rejected: Submittal is rejected. Provide submittal of specified materials for review.
  - 5. Do not permit submittals marked “rejected or revise and resubmit” to be used at the project site or elsewhere where work is in progress.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION - 013300

## SECTION 013516 - ALTERATION PROJECT PROCEDURES

### 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 special procedures for alteration work.

#### 1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- E. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- F. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- G. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- H. Retain: To keep existing items that are not to be removed or dismantled.
- I. Strip: To remove existing finish down to base material unless otherwise indicated.

#### 1.4 COORDINATION

- A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
  - 1. Schedule construction operations in sequence required to obtain best Work results.

2. Coordinate sequence of alteration work activities to accommodate the following:
  - a. Owner's continuing occupancy of portions of existing building.
  - b. Owner's partial occupancy of completed Work.
  - c. Other known work in progress.
  - d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.

## 1.5 PROJECT MEETINGS FOR ALTERATION WORK

- A. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Construction Manager, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
  2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
    - a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
    - b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
      - 1) Interface requirements of alteration work with other Project Work.
      - 2) Status of submittals for alteration work.
      - 3) Access to alteration work locations.
      - 4) Effectiveness of fire-prevention plan.
      - 5) Quality and work standards of alteration work.
      - 6) Change Orders for alteration work.
  3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Alteration Work Subschedule:
  - 1. Submit alteration work subschedule within seven days of date established for commencement of alteration work.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.
- C. Alteration Work Program: Submit 7days before work begins.
- D. Fire-Prevention Plan: Submit 7 days before work begins.

## 1.7 QUALITY ASSURANCE

- A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
- B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
  - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
  - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

## 1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

### A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label 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.

### B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

### C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

### D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.

### E. Storage Space:

1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security and climate control for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

## 1.9 FIELD CONDITIONS

### A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings.

### B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

- C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by **12 inches** or more.

## PART 2 - PRODUCTS - (Not Used)

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
  - 1. Use only proven protection methods, appropriate to each area and surface being protected.
  - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
  - 3. Erect temporary barriers to form and maintain fire-egress routes.
  - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
  - 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
  - 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
  - 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
- B. Temporary Protection of Materials to Remain:
  - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
  - 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
  - 1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
  - 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
  - 3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
  - 1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
  - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

### 3.2 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following:
  - 1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
  - 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
    - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
  - 1. Use of open-flame equipment is not permitted.
  - 2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
  - 3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
- C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

### 3.3 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

- D. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
  - 1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

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

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

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

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.

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

#### 1.6 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 five 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. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time 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.
  - 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 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.

## 1.7 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.
14. Furnish reports and documents to the Architect, the IOR, the Owner, and the Division of the State Architect.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.

5. Other required items indicated in individual Specification Sections.

- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

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

- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- 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:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.
  - 2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, the Owner and the Division of the State 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 in location and of size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
  - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 7. Demolish and remove mockups when directed unless otherwise indicated.

## 1.9 QUALITY CONTROL

### A. Owner Responsibilities:

1. Owner will employ and pay for services of an independent testing laboratory, approved by DSA, to perform specified inspection and testing.
2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
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, and the Contract Sum will be adjusted by Change Order.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
  - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

### C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

### D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

### E. 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.

- F. 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 location 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 to Architect, the Owner, and the Division of the State Architect.
  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 any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. 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.

#### 1.10 SPECIAL TESTS AND INSPECTIONS

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

- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews 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, Owner, and the Division of the State Architect with copy to Contractor.
  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 reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in 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.

## 1.4 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. 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. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  2. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  3. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
- C. 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. DSA - Division of the State Architect, California, [www.dgs.ca.gov](http://www.dgs.ca.gov).
  7. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
  8. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
  9. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  10. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  11. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
  12. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
  13. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
  14. SD - Department of State; [www.state.gov](http://www.state.gov).
  15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
  16. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
  17. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
  18. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
  19. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
  20. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations 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.gpo.gov/fdsys](http://www.gpo.gov/fdsys).

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/ccb](http://www.wbdg.org/ccb).
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).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. 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 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities including:

- 1. Temporary utilities required include but are not limited to:

- a. Water service and distribution
- b. Storm and sanitary sewer
- c. Electrical power and light
- d. Telephone service

- 2. Temporary construction and support facilities required include but are not limited to:

- a. Temporary heat
- b. Field offices and storage sheds
- c. Sanitary facilities, including drinking water
- d. Dewatering facilities and drains
- e. Temporary enclosures
- f. Hoists and lifts
- g. Temporary Project identification signs and bulletin boards
- h. Waste disposal services
- i. Rodent and pest control
- j. Construction aids and miscellaneous services and facilities

- 3. Security and protection facilities required include but are not limited to:

- a. Temporary fire protection
- b. Barricades, warning signs, lights
- c. Sidewalk bridge or enclosure fence for the site
- d. Environmental protection

- B. Related Requirements:

- 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

### 1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- C. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Dust and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste handling procedures.
  - 5. Other dust-control measures.

### 1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## 1.6 PROJECT CONDITIONS

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Inspector, Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of 8 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
  - 3. Drinking water.
  - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
  - 5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.
- C. Water Service: Connect to existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

- E. Heating: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service overhead unless otherwise indicated.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - 2. Install lighting for Project identification sign.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine in each field office.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Architect's office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
  - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide a desktop computer and printer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
  - 1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
  - 2. Internet Service.

3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
4. Backup: External hard drive with automated backup software providing daily backups.

### 3.3 SUPPORT FACILITIES INSTALLATION

#### A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

#### B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

#### C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

#### D. Parking: Provide temporary parking areas for construction personnel.

#### E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

#### F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
  - a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
  1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
  2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
  3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
  4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
  - 1. Prohibit smoking in construction areas.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard, replace, or clean stored or installed material that begins to grow mold.
  - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor.
  - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION - 015000

## SECTION 015723 - STORM WATER POLLUTION PREVENTION PLAN

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor and services necessary to prepare the SWPPP.
2. Provide all material, labor, equipment and services necessary to comply with the conditions of the Construction General Permit (CGP) No.
3. Implement the Best Management Practices (BMP) contained within the SWPPP or implement other practices deemed by the Contractor/QSP to better accomplish the intent of controlling the quality of runoff water from the Project Site.
4. All Contract requirements in Division 00 and 01.

B. This Section does not include:

1. A Notice of Intent (NOI) to be covered by the CGP will be filed by the Owner with the State Water Resources Control Board (SWRCB).
2. The Owner will pay for filing fees.
3. A Notice of Termination (NOT) to terminate the CGP coverage will be filed by the Owner with the SWRCB.

C. Acronyms:

- |           |   |
|-----------|---|
| 1. BMP    | Best Management Practices                       |
| 2. CARB   | California Air Resources Board                  |
| 3. CGP    | Construction General Permit Order               |
| 4. EPA    | Environmental Protection Agency                 |
| 5. NOI    | Notice of Intent                                |
| 6. NOT    | Notice of Termination                           |
| 7. NPDES  | National Pollution Discharge Elimination System |
| 8. QSD    | Qualified SWPPP Developer                       |
| 9. QSP    | Qualified SWPPP Practitioner                    |
| 10. SWPPP | Storm Water Pollution Prevention Plan           |
| 11. SWRCB | State Water Resources Control Board             |
| 12. RWQCB | Regional Water Quality Control Board            |

#### 1.2 RELATED SECTIONS

A. Section 311000 - Site Clearing

B. Section 312000 – Earth Moving

#### 1.3 SUBMITTALS

A. Submit the following in accordance with Section 013000:

1. SWPPP.

2. Addenda to the SWPPP.
3. Reports required by the SWPPP.

#### 1.4 QUALITY ASSURANCE

##### A. SWPPP Certification Requirements:

1. Qualified SWPPP Developer (QSD)
  - a. The SWPPP shall be written, amended and certified by a QSD. The SWPPP shall contain the name and telephone number of the QSD.
2. Qualified SWPPP Practitioner (QSP)
  - a. All BMPs required by the CGP shall be implemented by a QSP. A QSP is responsible for non-storm water and storm water visual observations, sampling and analysis.

##### B. Regulatory Requirements:

1. Prepare and implement the SWPPP in accordance the following:
  - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board CARB and the Environmental Protection Agency EPA. Regulatory changes may affect the formulation, availability, or use of the specified coatings. Confirm availability of coating to be used, prior to use, and notify the Engineer of any recent changes that may have occurred after the preparation of this specification section.
  - b. EPA Environmental Protection Agency.
  - c. SWRCB State Water Resources Control Board.
  - d. RWQCB Regional Water Quality Control Board.

## PART 2 - PRODUCTS

### 2.1 SOURCE QUALITY CONTROL

#### A. Storm Water Pollution Prevention Plan:

1. The SWPPP shall be prepared in accordance with the guidelines contained in the CGP issued by the SWRCB under the National Pollution Discharge Elimination System (NPDES) permit program of the EPA.
2. The intent of the CGP is to protect the quality of receiving water of the United States by limiting the quantity of pollutants in rainfall runoff from construction sites of one acre or more in area. In order to accomplish this goal, each construction activity is required to prepare a plan that will govern work operations activities to lessen the probability that pollutants will be present in rainfall runoff from their site.
3. This site shall be covered by the CGP by the time construction begins.
  - a. All construction activity must comply with the conditions of the permit.

- b. A NOI to be covered by the CGP will be filed by the Owner with the SWRCB and the fees will be paid by the Owner.
    - c. Copies of the NOI will be provided to the Contractor to place in the appropriate Appendix of the SWPPP when the NOI is available.
  - 4. The BMPs contained in the SWPPP shall meet the intent of the CGP.
    - a. The Owner does not have any responsibility for selecting or implementing the BMPs proposed by the Contractor and QSP to adequately control the quality of runoff from the site.
    - b. The Contractor must provide, implement, and carry out the BMPs that comply with the CGP regardless of the BMPs contained in the SWPPP.
    - c. The Contractor and QSP shall bear full responsibility for reviewing the proposed BMPs, ascertaining their ability to provide adequate controls, and implementing the BMPs or implementing others deemed by the Contractor to better accomplish the intent of controlling the quality of runoff water from the project site.
- B. Notice of Intent (NOI)
  - 1. A NOI to be covered by the CGP will be filed by the Owner with the SWRCB.
  - 2. A copy of the NOI will be provided to the Contractor.
- C. Notice of Termination (NOT)
  - 1. A NOT to terminate the CGP coverage will be filed by the Owner with the SWRCB.
  - 2. A copy of the NOT will be provided to the Contractor.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. General Requirements:
  - 1. The Contractor is to comply with the conditions of the CGP.
  - 2. The SWPPP is an aid to the Contractor in complying with the CGP.
  - 3. Under the terms of this Contract, the Contractor is the Operator/Discharger of the Project Site. It is the Contractor's and QSP's responsibility to faithfully and fully implement the BMPs.
- B. Best Management Practices (BMPs):
  - 1. The QSP shall at a minimum annually review the installation of the BMPs employed both prior to, and their performance during the rainy season. Should the QSP deem the BMPs proposed in the SWPPP are inadequate to meet the requirements of the CGP, or a change occurs in the nature or manner of construction operations not anticipated in the SWPPP, the QSP shall propose alternative BMPs that are equal to or better than those contained in the SWPPP.
  - 2. Should the Contractor implement alternative BMPs, he shall prepare all addenda to the SWPPP required by the CGP and notify the QSD for review of amendments to the original SWPPP.

3. Failure to implement the BMPs as required to meet the intent of the CGP and the SWPPP is a breach of state and federal laws. Punishment for breaking the law can result in fines and imprisonment.
4. BMPs shall be provided and maintained from commencement of the Work until final acceptance.

### 3.2 FIELD QUALITY CONTROL

#### A. Monitoring of BMPs

##### 1. Monitoring by QSP

- a. Carry out the Monitoring Program (annual, pre-storm, storm event, post-storm, routine inspections) as required by the SWPPP.
- b. Prepare and submit all reports to Owner and SWRCB as required by the SWPPP and the CGP.

##### 2. Monitoring by Owner

- a. The Owner will monitor the Contractor's implementation and maintenance of the BMPs.
- b. Should the Owner determine that the Contractor's efforts fail to meet the requirements of the CGP, the SWPPP, and SWPPP amendments, the Owner reserves the right to employ any and/or all of the following actions:
  - 1) Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
  - 2) Withhold an amount of money from the Contractor's Payment Request, equal to the Owner's estimate of the value of the work required to implement and maintain the required BMPs.
  - 3) Hire a separate QSP to perform work required to implement and maintain the BMPs and deduct the costs thereof from the Contractor's Payment.

#### B. Availability and access to the SWPPP

1. The Contractor shall keep copies of the SWPPP and Addenda thereto in the following locations:
  - a. Contractor's General Business Office.
  - b. Contractor's Project Site Field Office.
  - c. Construction Manager's Jobsite Office.
2. The SWPPP shall be available for public inspection at any time during normal business hours.

### 3.3 CLEANING AND REMOVAL

#### A. Removal of BMPs

1. Completely remove from the Project Site all materials used to construct and maintain the BMPs upon completion and acceptance of the Project.

2. Remove all accumulated debris and excess material from the BMPs and surrounding locations, and broom clean all adjacent hardscape surfaces to the satisfaction of the Owner.
- B. At the completion of the project, the Contractor shall leave in place all BMPs related to the stockpiled excess soil earmarked for use in the future tennis court area earthwork and grading. The Owner shall review the condition of BMPs at the stockpile area, and the Contractor shall make all necessary repairs and clean-up of the BMPs prior to the Owner's acceptance of the BMPs.
  - C. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent contractor for later work phases at the Project Site.

END OF SECTION 015723

## 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.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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

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

C. Storage:

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

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.

B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.

1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
2. 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 not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.

5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

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

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in 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 similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION (Not Used)

END OF SECTION - 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 011000 "Summary" for limits on use of Project site.
  - 2. Section 013300 "Submittal Procedures" for submitting surveys.
  - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 1.3 DEFINITIONS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor and professional engineer.
- B. Certificates: Submit certificate signed by land surveyor and professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least **7** 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.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

#### 1.5 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. 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, 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. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire-suppression systems.
    - c. Mechanical systems piping and ducts.
    - d. Control systems.
    - e. Communication systems.
    - f. Fire-detection and -alarm systems.
    - g. Conveying systems.
    - h. Electrical wiring systems.

3. 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. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Equipment supports.
    - d. Piping, ductwork, vessels, and equipment.
  4. 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.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- 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.

## 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, 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.
  - 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 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### 3.4 FIELD ENGINEERING

- A. 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.
- B. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful 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 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.
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. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, 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. Temporary Support: Provide temporary support of work to be cut.
- C. 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.
- D. 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.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- E. 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. 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 minimize 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. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 PROGRESS CLEANING

- A. General: 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.
  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 in Finished Areas: 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."

- 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 assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.8 STARTING AND ADJUSTING

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

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

END OF SECTION 017300

## 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.
5. Repair of the Work.

- B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

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

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

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

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, 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 where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  - 5. Submit test/adjust/balance records.
  - 6. Submit 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 heat and other utilities.
  - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

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

## 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to 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.
- 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- 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 and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Page number.
4. Submit list of incomplete items in the following format:
  - a. MS Excel electronic file. Architect will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. 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 public 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, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. 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. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - 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. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
      - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
    - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    - q. Leave Project clean and ready for occupancy.

- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION - 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.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment 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. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

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

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

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, 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. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (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.

## 2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.

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

## 2.4 OPERATION MANUALS

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

4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

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

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

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 one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:
  - a. Initial Submittal:
    - 1) Submit PDF electronic files of scanned record prints and one of file prints.
    - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
  - b. Final Submittal:
    - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
    - 2) Print each drawing, whether or not changes and additional information were recorded.

- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

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

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction 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 sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
  2. Format: DWG, Version Architecture 2012, Microsoft Windows operating system.
  3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  4. Refer instances of uncertainty to Architect for resolution.
  5. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 013300 "Submittal Procedures" 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. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

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

## 2.3 RECORD PRODUCT DATA

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

## 2.4 MISCELLANEOUS RECORD SUBMITTALS

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

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

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

END OF SECTION - 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.

- f. Date of video recording.
2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

## 1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.6 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Seasonal and weekend operating instructions.
    - l. Required sequences for electric or electronic systems.
    - m. Special operating instructions and procedures.
  5. Adjustments: Include the following:
    - a. Alignments.

- b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.

- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

## 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. Demolition and removal of selected site elements.
3. 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.

#### 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. Predemolition 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. 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. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- B. Predemolition 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.

## 1.7 CLOSEOUT SUBMITTALS

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

## 1.8 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 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. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Arrange to shut off utilities with the School Districts Representative.

### 3.3 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 equipment that has not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control specified in Section 015000 "Temporary Facilities and Controls."
- B. Remove temporary barricades and protections where hazards no longer exist.

### 3.4 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.
  - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 7. 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. 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.
- D. 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.
- E. 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.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings. Do not use methods requiring solvent-based adhesive strippers.

### 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
  - 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.
- 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

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 APPLICABLE SECTION

- A. The requirements/provisions of the General and Supplementary Conditions and Division 1 Specification Section shall apply to this section.

#### 1.2 DESCRIPTION OF WORK

- A. The work included under this section consists of furnishing all material, supplies, equipment, tools, transportation and facilities and performing all labor and services necessary for, required in connection with or properly incidental to furnishing and installing rough carpentry, as described in this section of the specifications, shown on the accompanying drawings, or reasonably implied therefrom.
- B. Work Included:
  - 1. Furnishing and installing wood framing and sheathing
  - 2. Furnishing and installing plywood sheathing
  - 3. Furnishing and installing light gage metal connectors
  - 4. Furnishing and installing bolts, lag screws, washers, spikes and nails necessary for connecting wood framing and sheathing
  - 5. Installing miscellaneous metal connectors

- C. Temporary bracing

#### 1.3 REFERENCE STANDARDS

- A. The following is a list of reference standards referred to in this portion of the specifications.
  - 1. ASTM A307, "Specification for Carbon Steel Externally Threaded Standard Fasteners"
  - 2. W.C.L.I.B., "Standard Grading and Dressing Rules No. 17."
  - 3. Federal Specification FF-N-105B with Interim Amendment 4.

#### 1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with all Federal, State and Local Codes and Safety Regulations. In addition, comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. California Building Code, current governing edition.
  - 2. National Forest Products Association, "National Design Specification for Wood Construction", current edition.
  - 3. American Plywood Association, "U.S. Product Standard PS1-09"
  - 4. American Institute of Timber Construction, American National Standard ANSI/AITC A190.1-2012 for Wood Products-Structural Glued Laminated Timber"
- B. Grade marks:
  - 1. All framing lumber shall be identified by the grade stamp of the West Coast Lumber Inspection Bureau.

2. All plywood shall be identified as to species, grade, and glue type, and shall bear the identification grade mark of the American Plywood Association.
3. All glu-lam beams shall be stamped with an AITC product quality mark.

C. Testing and Inspection:

1. The Owner shall employ an independent testing laboratory or the Engineer as the Owner's agent to perform the inspections and tests shown on the contract drawings and submit certified test results. The Contractor will cooperate with and notify Owner's agent at least 24 hours in advance of inspections required:

## 1.5 SUBMITTALS

A. General Requirements

1. Submittals shall be made to Architect in accordance with the requirements of Division 1 General Requirements of these specifications.
2. Construction of wood framing, glu-lam erection, and sheathing shall not begin until Contractor has received submittals reviewed by Architect governing all aspects of the intended work.

B. Product Data: Manufacturer's catalog sheets including instructions for use and description of application shall be provided on each of the following materials:

1. Light gage metal connectors

## 1.6 SEQUENCING AND SCHEDULING

- A. Obtain information and instructions from other trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be installed prior to or in conjunction with rough carpentry so provision for their work can be made without delaying the project.
- B. Do any cutting and repairing made necessary by failure or delay in complying with these requirements, at no cost to Owner.

## PART 2 - PRODUCTS

### 2.1 FRAMING

- A. General: Framing shall be Douglas Fir Coast Region, conforming to West Coast Lumber Inspection Bureau Standard Grading and Dressing Rule No. 17, as amended to date.
1. 2x, 3x, 4x, plates, joists, purlins and beams, No. 1 and better (1200F-b), Para. 123-b, unless noted otherwise on the drawings.
  2. 6x beams, Dense No. 1 (1550F-b). Para 130-bb.
  3. 2x, 3x, 4x ledgers, No. 1 (1000F-b), Para. 123-b, unless noted otherwise on the drawings.
  4. 2x, 3x studs and blocking, No. 1 (1000F-b), Para. 123-b.
- B. All framing lumber 6" or larger in the least dimension shall be F.O.H.C.

## 2.2 PLYWOOD

- A. General: Plywood shall conform to U.S. Product Standard PS 1-09, American Plywood Association. Each sheet shall be stamped with the PS and/or APA grademark.
- B. Roof Plywood
  - 1. Shall be 5 ply exposure 1, CDX, span rating 32/16, Species Group 2 or better.
- C. Wall Plywood
  - 1. Shall be 3 ply exposure 1, CDX, span rating 24/0, Species Group 2 or better.

## 2.3 ENGINEERED WOOD MEMBERS

- A. Laminated-Veneer Lumber: A composite of wood veneers with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D2559. Product has the following allowable design values as determined according to ASTM D5456:
  - 1. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
  - 2. Modulus of Elasticity, Edgewise: 2,000,000 psi.

## 2.4 LIGHT GAGE METAL CONNECTIONS

- A. Light gage metal connectors shall be Simpson Company Strong Tie Connectors, or equal unless noted otherwise on the drawings.

## 2.5 NAILS

- A. Nails shall be bright common wire nails, galvanized for exterior work and conform to Federal Specification FF-N-105B.
- B. Nailing shall conform to CBC Table 2304.10.1 unless otherwise noted.
- C. Nails in pressure treated lumber shall be hot dipped galvanized steel in compliance with ASTM A153.

## 2.6 SCREWS

- A. Lag screws shall conform to ANSI/ASME Standard B18.2.1.
- B. Wood screws shall conform to ANSI/ASME Standard B18.6.1.

## 2.7 BOLTS

- A. Bolts shall conform to ASTM A307, manufactured to American Standard Bolt and Nut dimensions with "Free Fit - Class 2" threads.
- B. Bolts in pressure treated lumber shall be hot dipped galvanized steel in compliance with ASTM A153.

## 2.8 PRESERVATIVE TREATMENT FOR WOOD

- A. Preservative Treatment for Wood: Water-borne, non-arsenic, non-chromium type complying with AWPAs Standard U1. Preservative treatment shall not contain pentachlorophenol, arsenic compounds, or creosote. In addition, the preservative treatment shall comply with the following:
  - 1. Material: Paintable.
  - 2. Comply with CARB limit on VOCs of 350 g/L using EPA Test Method 24.
  - 3. Moisture Content: After treatment, re-dry wood to be used in enclosed locations to a moisture content of 19% or less.
  - 4. Retreat all field cut ends and surfaces.

## 2.9 FIRE-RETARDANT-TREATED WOOD

- A. Fire Retardant Treatment: Waterborne chemical treatment to comply with AWPAs Standard P-5, achieve a flame spread index of 25 or less when tested in accordance with ASTM E84, and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10.5 feet beyond the centerline of the burners at any time during the test. Use of ammonium phosphates is prohibited.
- B. Apply in compliance with the applicable AWPAs Standard for type of wood and application.
- C. Provide fire retardant treatment for all wood noted on the Drawings to receive it.
- D. Where treated items are indicated on the Drawings to receive a transparent or opaque paint finish, use a fire retardant treatment which will not bleed through or adversely affect the bond of the finish material.
- E. Structural performance of fire retardant wood shall meet requirements of ASTM D5664 for lumber & ASTM D5516/D6305 for plywood.
- F. Provide labeling in conformance with CBC Section 2303.2.4 on all fire treated material delivered to the job site.
- G. Acceptable manufactures and products:
  - 1. Koppers Performance Chemicals FirePRO
  - 2. Hoover Treated Wood Products, Inc. Pyro-Guard
  - 3. Hoover Treated Wood Products, Inc. Exterior Fire-X
  - 4. Approved Equal

## PART 3 - EXECUTION

### 3.1 GENERAL REQUIREMENTS

- A. All framing operations shall conform to the requirements of the California Building Code.

- B. Set horizontal and sloped members with crown up. Do not notch, bore or cut members for pipes, ducts, conduits, or other reasons except as shown on the drawings or as specifically approved by the Architect/Engineer. Make all bearings full and all blocking solid unless otherwise indicated on the drawings. Finish all bearing surfaces on which structural members are to rest so as to give sure and even support. Where framing members slope, cut or notch the ends as required to give uniform bearing surface.
- C. Joists shall be set with the crowning edge up except at cantilevers.
- D. Solid blocking shall be placed at ends of spans and over supports. Cross-Bridging or solid blocking in spans shall not exceed 8 feet or less if shown on structural drawings.
- E. Furnish and set all columns and studs to size, centers, and locations indicated on the drawings. Unless marked otherwise, studs for furring and partitions shall be 2x4 or 2x6, set 16" o.c. plates on concrete floors shall not be set until the concrete is finished. Cripples shall be run to the floor plates.
- F. Remove all wood, including form lumber, scrap lumber, shavings and sawdust in contact with ground. Leave no wood buried in any fill or backfill.
- G. Furring and blocking shall be furnished and installed where required for reception of wallboard, formation or architectural features, concealment of pipes, conduits, ducts, attachment of supports for towel holders, toilet paper holders, and other fixtures. Contractor shall consult with the trades concerned and set furring and blocking they require.
- H. Fire Blocking shall be installed as shown on drawings and in accordance with the applicable Building Code.
- I. Framing of openings through walls, floors, attics, and roofs shall be provided for roof vents, mechanical equipment, lighting fixtures, ducts, etc. Where one or more joists are cut, the joists supporting the trimmers shall be framed in accordance with the drawings or if not detailed shall be doubled and well spiked. Where continuation of three or more joists is interrupted, the abutting headers and joists shall be reinforced with approved type of joists hangers.
- J. Center joints or plywood accurately over supports and nail into solid wood. Protect all plywood from moisture by use of all required waterproof covering until the plywood has in turn been covered by the next succeeding component or finish.
- K. Lumber not grade stamped, and lumber of improper grade, shall be removed from the job site and immediately replaced by grade stamped lumber of the proper grade.
- L. Other Materials: All other lumber materials, not specifically described but required for the proper completion of the work, shall be new, first quality of their respective kinds and subject to the approval of the Architect/Engineer.
- M. Where the plans do not require solid blocking or a tongue and groove connection at edges of plywood or OSB sheathing, the sheathing edges shall be supported with ply clips or ply cleats.

### 3.2 EXAMINATION

- A. Surface Conditions: Prior to the work of this section, carefully inspect the installed work of other trades and verify that all such work has been so installed as to allow rough carpentry to produce surfaces to the required design.

### 3.3 WORKMANSHIP

- A. All rough carpentry shall produce joints true, tight, and well nailed with all members assembled in accordance with the drawings and with all pertinent regulations.
- B. Cut all wood members to fit. Do not shim.
- C. Erect all members straight, plumb and accurately located.
- D. Carefully select all structural members. Select individual pieces so that knots and obvious defects will not interfere with making proper connections. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, or crook, or for mildew, fungus or mold as well as for improper cutting or fitting. Cut out and discard all defects which render a piece unable to serve its intended function.

### 3.4 INSTALLATION

- A. Plates: Plates for partitions and walls shall be single at bottom and double at top. Splices in top plates shall be staggered not less than 48". Where plates are cut for passing pipes and similar items, they shall be reinforced on both sides with 1/8"x3"x18" steel plates punched for 10d nails 6" on center, staggered.
- B. Power Driven Inserts: Wherever furring of any kind is attached to concrete or masonry, including lower plates to floors, the members shall be secured with 1/4" power driven inserts. Plates anchored to concrete floors shall be attached with pins not over 3 feet on center. All studs on vertical furring shall be attached with pins not over 4 feet on center. Each insert shall penetrate the concrete to a minimum of 1-1/2". Use washers with all inserts.

### 3.5 ERECTION

- A. The Contractor will be responsible to erect the wood framing true to line and grade.
- B. Temporary Bracing and Shoring:
  - 1. The Contractor shall temporarily brace the wood framing in both directions and shall maintain walls, joists, beams, and other framing members plumb until the final connections of the framework and construction of diaphragms are complete.
  - 2. The Contractor shall provide such temporary shoring and additional bracing of wood framing as required to support adequately and safely any or all loads imposed upon the structure during construction.

### 3.6 CLEAN UP

- A. In addition to the requirements of General Conditions, keep premises clean and clear of debris caused from this portion of the work. Failure to perform clean up within 24 hours' notice by the Architect or General Contractor shall be considered adequate grounds for having the work done by others at this subcontractor's expense.

### 3.7 FIELD QUALITY CONTROL

- A. Inspections: The Owner's agent will perform the inspections as shown on the contract drawings.

END OF SECTION 061000

## SECTION 072100 - THERMAL INSULATION

### 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. Glass-fiber blanket.
- 2. Mineral-wool blanket.

- B. Related Requirements:

- 1. Section 075113 "Built-up Asphalt Roofing for insulation specified as part of roofing construction.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

### PART 2 - PRODUCTS

#### 2.1 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. CertainTeed Corporation.
  - 2. Guardian Building Products, Inc.
  - 3. Johns Manville.

4. Knauf Insulation.
5. Owens Corning.

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## 2.2 MINERAL-WOOL BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Fibrex Insulations Inc.
  2. Owens Corning.
  3. Roxul Inc.
  4. Thermafiber.
- B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## 2.3 VAPOR RETARDERS

- A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Raven Industries Inc.; DURA-SKRIM 6WW.
    - b. Reef Industries, Inc.; Griffolyn T-65.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

## 2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
  1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

## 2.5 INSULATION FASTENERS

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  - 5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

### 3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION - 072100

## SECTION 073113 - ASPHALT SHINGLE PATCHING

### 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. Asphalt shingles.
  - 2. Underlayment.
  - 3. Demolition of existing asphalt shingle roofing in locations where new mechanical equipment is being placed.

#### 1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
  - 1. Asphalt Shingles: Full size.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.

#### 1.6 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. Asphalt Shingles: One package of asphalt shingles matching shingles installed..

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.
- B. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

### 2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462/D 3462M, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing. Match existing roofing shingles.

### 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 40-mil-thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release backing; cold applied
- B. Insulation: Polyisocyanurate Board Insulation, ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

### 2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking.
  - 1. Shank: Barbed.
  - 2. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt-Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.
- D. Synthetic-Underlayment Fasteners: As recommended in writing by synthetic-underlayment manufacturer for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Examine roof decking to verify that decking is supported by framing and blocking, and that installation is within flatness tolerances.
  - 2. Demolition:
    - a. Remove existing asphalt shingle roofing and base plies at areas indicated to receive new mechanical equipment. Cut holes in laminated roof deck to receive new ductwork. Coordinate with installation of new equipment platforms.
    - b. Remove existing asphalt shingles back far enough to lap over new shingles being installed.
  - 3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 RIGID INSULATION INSTALLATION

- A. Replace rigid insulation where damaged or removed.
- B. Provide pressure treated blocking at edges of installed insulation.

### 3.3 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

- B. Single-Layer Felt Underlayment: Install on roof deck parallel with laminated roof deck and overlapping existing underlayment. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 Fasten with roofing nails.
  - 1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction that sheds water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.
- C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

### 3.4 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
  - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- C. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

### 3.5 ASPHALT-SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest point of roof patch, consisting of an asphalt-shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt-shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.
  - 1. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
  - 2. When ambient temperature during installation is below 50 deg F seal asphalt shingles with asphalt roofing cement spots.

END OF SECTION 073113

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

### 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. Counterflashing for Manufactured reglets specified in Section "092400 Cement Plastering".
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.
5. Formed equipment support flashing.

- B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 092400 "Portland Cement Plastering " for materials and installation of reglets.

#### 1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

#### 1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

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

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## 1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure 110 MPH.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755.
  - 1. Surface: Smooth, flat and mill phosphatized for field painting steel not factory finished.
  - 2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides for factory finished sheet metal..

3. Exposed Coil-Coated Finish:
  - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

### 2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

### 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, **solder**, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  2. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.
- C. Solder:
  1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
  - 1. Material: Galvanized steel, 0.022 inch thick.
  - 2. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  - 3. Accessories:
    - a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
  - 4. Finish: With manufacturer's standard color coating.

## 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

## 2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.
  1. Coping Profile: Fig 3-4B according to SMACNA's "Architectural Sheet Metal Manual."
  2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
  3. Fabricate from the Following Materials:
    - a. Coil Coated Galvanized Steel: 0.040 inch (20 GA,) thick.
- B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  1. Galvanized Steel: 0.028 inch (24 GA,) thick.
- C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  1. Galvanized Steel: 0.022 inch (24 ga.) thick.
- D. Flashing Receivers: Fabricate from the following materials:
  1. Galvanized Steel: 0.022 inch (24 ga.) thick.

## 2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Drip Edges: Fabricate from the following materials:
  1. Galvanized Steel: 0.022 inch (24 GA.) thick.
- B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  1. Galvanized Steel: 0.022 inch (24 ga.) thick.

C. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch (24 GA.) thick.

## 2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (22 ga.) thick.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

### 3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  5. Torch cutting of sheet metal flashing and trim is not permitted.
  6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not use torches for soldering.
  2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
  - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
  - 2. Anchor interior leg of coping with continuous cleat anchored to substrate at 24-inch centers.
  - 3. Provide Springlok flashing system below copings to provide positive upward pressure on coping..
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant unless otherwise indicated.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

### 3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets: Installation of reglets is specified in Section 09 24 00 "Portland Cement Plastering."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

### 3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

### 3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.8 CLEANING AND PROTECTION

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION - 076200

## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Polysulfide joint sealants.
4. Latex joint sealants.
5. Preformed joint sealants.
6. Acoustical joint sealants.

- B. Related Sections:

1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 079500 "Expansion Control" for building expansion joints.
3. Section 088000 "Glazing" for glazing sealants.
4. Section 092900 "Gypsum Board" for sealing perimeter joints.
5. Section 093000 "Tiling" for sealing tile joints.
6. Section 095113 "Acoustical Panel Ceilings for sealing edge moldings at perimeters with acoustical sealant.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
  - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

#### 1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

- F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 790.
    - b. GE Advanced Materials mOMENTIVE - Silicones; SilPruf LM SCS2700.
    - c. Pecora Corporation; 890 NST.
    - d. Sika Corporation, Construction Products Division; SikaSil-WS290.
    - e. Tremco Incorporated; Spectrem 1.
- B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 756 SMS.
    - b. GE Advanced Materials - Silicones; SilGlaze II SCS2800
    - c. Pecora Corporation; 864.
    - d. Sika Corporation, Construction Products Division; SikaSil-WS0295.
    - e. Tremco Incorporated; Spectrem 3.
- C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 799.
    - b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
    - c. Tremco Incorporated; Tremsil 600.
- D. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; NS Parking Structure Sealant.
    - b. Pecora Corporation; 311 NS.
    - c. Tremco Incorporated; Spectrem 800.

- E. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 890-SL.
    - b. Pecora Corporation; 300 SL or 310 SL.
    - c. Tremco Incorporated; Spectrem 900 SL.
  
- F. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Tremco Incorporated; Spectrem 4TS.
  
- G. Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; FC Parking Structure Sealant.
    - b. May National Associates, Inc.; Bondaflex Sil 728 RCS.
  
- H. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation; 898.

### 2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
    - b. Tremco Incorporated; Vulkem 921.
  
- B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP1.

- b. Bostik, Inc.; Chem-Calk 900.
  - c. Pecora Corporation; Dynatrol I-XL.
  - d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
  - e. Tremco Incorporated; Vulkem 116.
- C. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.
- 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP1.
    - b. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
    - c. Sika Corporation, Construction Products Division; Sikaflex - 1a.
    - d. Tremco Incorporated; Vulkem 116.
- D. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP 2.
    - b. Pecora Corporation; Urexpam NR-201.
    - c. Sika Corporation. Construction Products Division; Sikaflex - 1CSL.
    - d. Tremco Incorporated; Vulkem 45SSL.
- E. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation; Dynatrol II.
    - b. Tremco Incorporated; [Dymeric 240] [Dymeric 240 FC].
- F. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP 2.
    - b. Pecora Corporation; Dynatred.
    - c. Sika Corporation, Construction Products Division; [Sikaflex - 2c NS] [Sikaflex - 2c EZ Mix].
    - d. Tremco Incorporated; Vulkem 227.

- G. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Tremco Incorporated; Dymeric 240 FC.
- H. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP 2.
    - b. Pecora Corporation; Dynatred.
    - c. Sika Corporation, Construction Products Division; [Sikaflex - 2c NS] [Sikaflex - 2c EZ Mix].
    - d. Tremco Incorporated; Vulkem 227.
- I. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP1.
    - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
    - c. Tremco Incorporated; Vulkem 116.
- J. Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Sika Corporation, Construction Products Division; Sikaflex - 1CSL.
    - b. Tremco Incorporated; Vulkem 45.
- K. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP 2.
    - b. Pecora Corporation; Dynatred.
    - c. Tremco Incorporated; Vulkem 227.

- L. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Tremco Incorporated; Vulkem 245.

## 2.4 POLYSULFIDE JOINT SEALANTS

- A. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. W. R. Meadows, Inc.; Deck-O-Seal One Step.
- B. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal Polysulfide Sealant.
    - b. Pecora Corporation; Synthacalk GC-2+.
    - c. W. R. Meadows, Inc.; Deck-O-Seal Gun Grade.
- C. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
  - 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal Polysulfide Sealant.
    - b. Pecora Corporation; Synthacalk GC-2+.
- D. Multicomponent, Pourable, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. W. R. Meadows, Inc.; [Deck-O-Seal 125] [Deck-O-Seal 150].
- E. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation; Synthacalk GC-2+.

## 2.5 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; Masterseal NP-520.
    - b. Pecora Corporation; AC-20+.
    - c. Tremco Incorporated; Tremflex 834.

## 2.6 SOLVENT-RELEASE-CURING JOINT SEALANTS

- A. Acrylic-Based Joint Sealant: ASTM C 1311.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Tremco Incorporated; Mono 555.
- B. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik, Inc.; Chem-Calk 300.
    - b. Pecora Corporation; BC-158.
    - c. Tremco Incorporated; Tremco Butyl Sealant.

## 2.7 PREFORMED JOINT SEALANTS

- A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 123 Silicone Seal.
    - b. GE Advanced Materials - Silicones; UltraSpan US1100.
    - c. Pecora Corporation; Sil-Span.
    - d. Sealex, Inc.; ImmerSeal.

- B. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dayton Superior Specialty Chemicals; Polytite Standard.
    - b. EMSEAL Joint Systems, Ltd.; Emseal 25V.
    - c. Sandell Manufacturing Co., Inc.; Polyseal.
    - d. Schul International, Inc.; Sealtite or Sealtite 50N.
    - e. Willseal USA, LLC; Willseal 150 or Willseal 250.

## 2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation; AC-20 FTR or AIS-919.
    - b. USG Corporation; SHEETROCK Acoustical Sealant.

## 2.9 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
  - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
  - 1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
  3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
  4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-#1.
1. Joint Locations:
    - a. Control and expansion joints in brick pavers.
    - b. Isolation and contraction joints in cast-in-place concrete slabs.
    - c. Joints between plant-precast architectural concrete paving units.
    - d. Joints in stone paving units, including steps.
    - e. Tile control and expansion joints.
    - f. Joints between different materials listed above.
    - g. Other joints as indicated.
  2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion JS-#2.
1. Joint Locations:
    - a. Joints in pedestrian plazas.
    - b. Joints in swimming pool decks.
    - c. Other joints as indicated.
  2. Polysulfide Joint Sealant: Immersible, multicomponent, nonsag, traffic grade.
  3. Joint Sealant: W. R. Meadows, Inc.; Deck-O-Seal One Step or equivalent.
  4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#3.
1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Joints between plant-precaster architectural concrete units.
    - c. Control and expansion joints in unit masonry.
    - d. Joints in dimension stone cladding.
    - e. Joints in glass unit masonry assemblies.
    - f. Joints in exterior insulation and finish systems.
    - g. Joints between metal panels.
    - h. Joints between different materials listed above.
    - i. Perimeter joints between materials listed above and frames of doors], windows, and louvers.
    - j. Control and expansion joints in ceilings and other overhead surfaces.
    - k. Other joints as indicated.
  2. Urethane Joint Sealant: Single component, nonsag.
  3. Joint Sealant: Sikaflex 1a or equivalent.
  4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#4.
1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in stone flooring.
    - c. Control and expansion joints in brick flooring.
    - d. Control and expansion joints in tile flooring.
    - e. Other joints as indicated.
  2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
  3. Joint Sealant: : InterioPecora Corporation; 311 NS.

- E. r joints in vertical surfaces and horizontal nontraffic surfaces JS-#5.
1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Tile control and expansion joints.
    - d. Vertical joints on exposed surfaces of walls and partitions.
    - e. Joints on underside of plant-precast structural concrete.
    - f. Perimeter joints between interior wall surfaces and frames of interior doors and windows
    - g. Other joints as indicated.
  2. Latex joint Sealant: BASF Building Systems; Masterseal NP-520 or equivalent..
- F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#6.
1. Joint Sealant Location:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated.
  2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces JS-#7.
1. Joint Location:
    - a. Acoustical joints where indicated.
    - b. Other joints as indicated.
  2. Joint Sealant: Acoustical.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

## SECTION 092900- GYPSUM BOARD

### 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. Interior gypsum board.
- 2. Tile backing panels.
- 3. Texture finishes.

- B. Related Requirements:

- 1. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

#### 1.3 ACTION SUBMITTALS

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

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- 2. Textured Finishes: 24" x 24" for each textured finish indicated and on same backing indicated for Work.

#### 1.4 QUALITY ASSURANCE

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. Lafarge North America Inc.
  - 5. National Gypsum Company.
  - 6. PABCO Gypsum.
  - 7. Temple-Inland.
  - 8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396. Use Type X typically throughout except where moisture resistant board is required.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Gypsum Ceiling Board: ASTM C 139.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.

- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
  - 1. Core: 5/8 inch.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C-Cure; C-Cure Board 990.
    - b. CertainTeed Corp.; FiberCement BackerBoard.
    - c. Custom Building Products; Wonderboard.
    - d. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
    - e. James Hardie Building Products, Inc.; Hardiebacker.
    - f. National Gypsum Company, Permabase Cement Board.
    - g. USG Corporation; DUROCK Cement Board.
  - 2. Thickness: 5/8 inch.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    - b. Grabber Construction Products; Acoustical Sealant GSC.
    - c. Pecora Corporation; AC-20 FTR.
    - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    - e. USG Corporation; SHEETROCK Acoustical Sealant.
  - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; ProRoc Easi-Tex Spray Texture.
    - b. National Gypsum Company; Perfect Spray EM Texture.
    - c. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.

- C. Finishes: Comply with finish as scheduled or noted and as defined by Drywall Industry Trust Fund, 9800 Sepulveda Blvd. Los Angeles, California 90005, Phone (213) 776-4555 or (415) 568-4060.

1. Schedule Designation/Finish:

- a. G.B.1 – Fog and Splatter
- b. G.B.2 – Skip Trowel
- c. G.B.3 – Ceiling textur Heavy Finish
- d. G.B.4 – Smooth
- e. G.B.5 – Knock Down
- f. G.B.6 – Fog
- g. G.B.7 – Orange Peel (Light)
- h. G.B.8 - Orange Peel (Heavy)
- i. G.B.9 – Roller Texture
- j. G.B.10 – Swirl Texture

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.

- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: As indicated on Drawings.
  - 2. Type X: Where required for fire-resistance-rated assembly.
  - 3. Ceiling Type: Ceiling surfaces.
  - 4. Moisture- and Mold-Resistant Type: At restrooms and food service areas.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - 3. Fastening Methods: Apply gypsum panels to supports with steel wallboard screws.

### 3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

### 3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Where indicated on Drawings.
  3. Level 3: Where indicated on Drawings.
  4. Level 4: At panel surfaces that will be exposed to view.
  5. Level 5: At smooth and level finished panels.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

### 3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION - 092900

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### 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 acoustical panels and exposed suspension systems for interior ceilings.

#### 1.3 CODES AND STANDARDS

- A. 2019 California Building Code.
- B. Comply with requirements of California Department of General Services, Division of State Architect Interpretative of Regulations Document IR 25-2.19 Metal Suspension Systems for Lay-In Panel Ceilings.
- C. Guidelines For seismic Restraint For Direct Hung suspended Ceiling assemblies. Seismic Zones 3 and 4, seismic design categories D, E and F. CISCA latest edition.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.
  - 3. Clips: Full-size hold-down and seismic clips.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.

5. Size and location of initial access modules for acoustical panels.
  6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Access panels.
    - g. Perimeter moldings.
  7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
  8. Minimum Drawing Scale: 1/8 inch = 1 foot.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
  2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  3. Seismic Clips: Equal to 2 percent of quantity installed.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E 1264.
  - 2. Smoke-Developed Index: 50 or less.

### 2.3 ACOUSTICAL PANELS ACP-1:

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc Cortega 703. or comparable product by one of the following:
  - a. American Gypsum.
  - b. CertainTeed Corporation.
  - c. Chicago Metallic Corporation.
  - d. Rockfon (Roxul Inc.).
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
  - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
  - 2. Pattern: CD (perforated, small holes and fissured).
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.82.
- F. Ceiling Attenuation Class (CAC): Not less than 33.
- G. Edge/Joint Detail: Angled tegular.
- H. Thickness: 5/8 inch.
- I. Modular Size: 24 by 48 inches.

- J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 METAL SUSPENSION SYSTEM

- A. Basis of Design Subject to compliance with requirements, provide Armstrong World Industries, Inc Prelude 15/16 inch exposed tee ESR 1308 or comparable product by one of the following:
  - 1. CertainTeed Corporation.
  - 2. Chicago Metallic Corporation.
  - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
  - 4. Rockfon (Roxul Inc.)
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635 and designated by type, structural classification, and finish indicated.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges' ESR 1308.
  - 1. Structural Classification: Heavy-duty system.
  - 2. Face Finish: Painted white.
- D. Seismic Beam Retaining Clip:
  - 1. ArmstrongBERC2 beam retaining clip.

## 2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
  - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch- diameter wire.
- C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corporation.
  - 3. Chicago Metallic Corporation.
  - 4. Fry Reglet Corporation.
  - 5. Gordon, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
  - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

## 2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 6. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
  - 1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  - 3. Install seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
    - a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

### 3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION - 095113

## SECTION 099000 - PAINTING

### PART 1: GENERAL

#### 1.1 SUMMARY:

- A. Included: Paint or otherwise finish all interior and exterior exposed surfaces, except as specifically excluded herein and as customarily excluded by general practices of the industry.
- B. Work Not Included:
  - 1. Do not include painting which is specified under other sections.
  - 2. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
  - 3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be specified herein.
  - 4. Do not paint any moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts, unless otherwise indicated.
  - 5. Do not paint over any required labels or equipment identification, performance rating, name, or nomenclature plates.
  - 6. Do not paint piping, conduit, panels and similar items in mechanical rooms, except when mechanical, storage, janitor or other such rooms are scheduled to receive a painters or integrally colored finish.
- C. Related Sections:
  - 1. Paint: Priming or priming and finishing of certain surfaces are specified to be factory performed or installer performed under other pertinent sections.

#### 1.2 DEFINITIONS:

- A. All coating system materials include primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

#### 1.3 SUBMITTALS:

- A. General: Submit the following according to Conditions of the contract and Division 1 Specifications Sections.
- B. Product Data: For each paint system specified:
  - 1. Manufacturer's technical information, including label analysis, instructions for handling, storage and application of each material.
  - 2. Material listing by cross referencing specific coating, finish system and application. Identify each material by the manufacturers catalog numbers and classification.
  - 3. Indicate by transmittal that a copy of each manufacturer's instructions have been submitted to the applicator.

- C. Certification: Manufacturers certification that products supplied comply with local regulations controlling use of volatile organic compounds (V.O.C.'s)
- D. Samples: Provide manufacturers color charts for initial color selection.
- E. Samples: For verification purposes provide four 12"x12" swatches of color and finish for each system specified on actual substrate and texture scheduled to receive finishes.

#### 1.4 QUALITY ASSURANCE:

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of painting products and with a history of successful production acceptable to the Architect.
- B. Applicator Qualifications:
  - 1. Provide at least one person who shall be present at all times during execution of the work of this Section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this Section.
  - 2. Provide adequate numbers of workmen skilled in the necessary crafts and properly informed of the methods and materials to be used.
- C. Single-Source Responsibility: Provide primers and undercoat paint products produced by the same manufacturers as the finish coats.
- D. Paint Coordination:
  - 1. Provide finish coats which are compatible with the prime coats used.
  - 2. Review other sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
  - 3. Upon request, furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used.
  - 4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
  - 5. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coating supplied under other sections.
- E. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place work.
  - 1. Final acceptance of colors will be from job-applied samples.
  - 2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface according to the schedule or as specified.
    - a. After finishes are accepted, this room or surface will be used to evaluate coating systems of a similar nature.

#### 1.5 PRODUCT HANDLING:

- A. Delivery of Materials: Deliver all materials to the job site in original, new, and unopened containers bearing the manufacturer's name and label showing at least the following information:
  - 1. Name or title of the material
  - 2. Product description
  - 3. Manufacturer's stock number and date of manufacture
  - 4. Contents by volume, for pigment and vehicle constituents
  - 5. Thinning instructions
  - 6. Application instructions
  - 7. Color name and number
  - 8. M.S.D.S. sheets for each product specified.
  
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg. C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### 1.6 JOB CONDITIONS:

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F. (10 deg C) and 90 deg F (32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg. F (7 deg C) and 95 deg F (35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

#### 1.7 PROTECTION:

- A. Protect adjacent surfaces from damage or defacement resulting from the work of this Section.

#### 1.8 EXTRA STOCK:

- A. Amount: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 5% of each color, type, and gloss of paint used on the work.
- B. Packaging: Tightly seal each container and clearly label with the contents and location used.

## PART 2: PRODUCTS

### 2.1 PAINT MATERIALS:

- A. Design is based upon the use of paint products manufactured by PPG Industries, Inc., and the systems of that manufacturer are listed in the SCHEDULE OF PAINT SYSTEMS included in PART 3 of this Section. Commensurate products and systems of Dunn Edwards, Sherwin-Williams Company, Kelly- Moore or approved equal will be considered for approval. Products must comply with requirements of current regulations of the California Air Resources Board and local authority having jurisdiction.
- B. Durability: Provide paints of durable and washable quality. Do not use paint materials which will not withstand normal washing as required to remove pencil marks, ink, ordinary soil, and similar material without showing discoloration, loss of gloss, staining, or other damage.
- C. Colors and Glosses: The Architect will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from the material proposed to be used in the work.
- D. Undercoats and Thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

### 2.2 APPLICATION EQUIPMENT:

- A. General: For application of the approved paint, use only such equipment as is recommended by the manufacturer of the particular paint, and as reviewed by the Architect.
- B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

2.3 OTHER MATERIALS: All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kind, and as selected by the Contractor subject to review by the Architect.

## PART 3: EXECUTION

### 3.1 SURFACE CONDITIONS:

- A. Inspection: Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where the work of this Section may properly commence. Verify that painting may be completed in strict accordance with the original design and with the manufacturers' recommendations as reviewed by the Architect.
- B. Discrepancies: Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 MATERIALS PREPARATION:

#### A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations.
2. Store materials not in actual use in tightly covered containers.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

#### B. Stirring: Stir all materials before application and as required during application to produce a uniform mixture. Do not stir surface film which may develop into the material; strain the material if necessary before using.

### 3.3 SURFACE PREPARATION:

#### A. General:

1. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations as approved by the Architect.
2. Remove all removable items which are in place and are not scheduled to receive paint finish, or provide surface-applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.
4. Clean and prepare each surface to be painted prior to applying paint or surface treatment.
5. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

#### B. Preparation of Wood Surfaces:

1. Clean all wood surfaces until they are free from dirt, oil, and all other foreign substance.
2. Smooth all finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
3. Unless specifically directed by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture-meter.

#### C. Preparation of Metal Surfaces:

1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.
2. On galvanized surfaces, prepare per paint manufacturer's recommendations for specified paint system.
3. Allow to dry thoroughly before application of paint.

#### D. Preparation of Concrete, Plaster or Gypsum Wallboard Surfaces:

1. Thoroughly clean all surfaces until they are free of dust, dirt, oil and grease.
2. Patch holes and cracks to render patch as imperceptible as reasonably possible.

E. Surfaces Not Mentioned:

1. Prepare surfaces not mentioned above in accordance with manufacturer's printed directions. In the absence of manufacturer's directions, prepare in accordance with procedures customarily employed, subject to review by the Architect.

3.4 PAINT APPLICATION:

A. General:

1. Slightly vary the color of succeeding coats. Do not apply additional coats until the complete coat has been inspected. Only the inspected and reviewed coats of paint will be considered in determining the number of coats applied.
2. Sand and dust between enamel coats to remove all defects visible to the unaided eye from a distance of five feet.
3. On all removable panels and all hinged panels, paint the back sides to match the exposed sides.

B. Drying:

1. Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.

C. Brush Application: Brush out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

D. Spray Application:

1. Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
2. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

E. Exposed Plumbing, Mechanical and Electrical Items:

1. Except when specified otherwise, paint conduits, pipes, ducts, grilles, registers, vents, access panels and similar items to match adjacent wall and/or ceiling finish. Paint visible surfaces behind registers, etc., flat black. Do not paint valve stems and bonnets.

F. Doors: In addition to both faces of doors, paint all four edges. Paint surfaces inaccessible after doors are installed prior to hanging.

G. Drawers and Shelves: Provide one coat of clear lacquer or approved equal to all interior surfaces of drawers, concealed shelves and the interior of casework at shelves.

H. Repainting: Extend finish material to a corner or similar transitional line, i.e., blend-in paint at patched area. When required, painting an entire wall may be necessary to achieve a reasonably imperceptible appearance at patched area.

- I. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

### 3.5 PAINT SYSTEMS:

- A. Paint system scheduled and noted on drawings. Refer to the complete corresponding paint systems as hereinafter specified. Major areas only are scheduled, but all miscellaneous items and areas within the room or space shall be treated with a suitable system.
- B. The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number, additional coats shall be applied without additional cost to the Owner, as necessary to produce a finish acceptable to Architect.

### 3.6 SURFACES NOT SPECIFIED:

- A. Other surfaces not included in the above schedule but which are scheduled or otherwise required to be painted shall be prepared and painted with a system selected by the Contractor subject to Architect's review.

**PAINT SYSTEMS SCHEDULE**

Paint systems used on this project are identified by an X in the finish schedule designation.

Surface		Finish Schedule Designation			Manufacturer's System Designation	
<b>A. Interior</b>						
(1)	Gypsum Drywall	P12.A	Flat, Latex Emulsion	1 <sup>st</sup> Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2 <sup>nd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
				3 <sup>rd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P12.B X	Semi-Gloss Latex Emulsion	1 <sup>st</sup> Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2 <sup>nd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3 <sup>rd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P12.C X	Eggshell Enamel Latex	1 <sup>st</sup> Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2 <sup>nd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3 <sup>rd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
	P12.D X	Semi-Gloss Enamel, Alkyd	1 <sup>st</sup> Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.	
			2 <sup>nd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.	
			3 <sup>rd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.	
	(Textured)	P12.E	Flat	1 <sup>st</sup> Coat	47-110	PPG MULTI-PRO™ Interior Flat Latex Wall & Ceiling Paint 47-110 Series.

(2)	Interior Wood	P13.A X	Semi-Gloss Latex	1 <sup>st</sup> Coat	17-951	PPG SEAL GRIP® Interior Primer/Finish
				2 <sup>nd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3 <sup>rd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P13.B X	Eggshell Enamel, Latex	1 <sup>st</sup> Coat	17-951	PPG SEAL GRIP® Interior Primer/Finish 17-951.
				2 <sup>nd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3 <sup>rd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P13.C	Semi-Gloss Enamel Alkyd	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2 <sup>nd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3 <sup>rd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
		P13.D	Lacquer Flat	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1 <sup>st</sup> Coat	500-0279	Gemini Gem Coat Low V.O.C Flat Lacquer
				2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	500-0279	Gemini Gem Coat Low V.O.C Flat Lacquer
		P13.E	Lacquer Satin	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1 <sup>st</sup> Coat	41061	PPG OLYMPIC Premium Interior Water Based Sanding Sealer 41061.
				2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	42786	PPG OLYMPIC® Premium Interior Water Based <b>Polyurethane</b> Clear 42786
		P13.F	Lacquer Semi-Gloss	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1 <sup>st</sup> Coat	500-0277	Gemini Gem Coat Low V.O.C Semi-gloss Lacquer
				2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	500-0277	Gemini Gem Coat Low V.O.C Semi-gloss Lacquer
P13.G	Lacquer Gloss	Stain	44500	PPG OLYMPIC® Interior Oil		

					Based Wood Stain 44500.
			1 <sup>st</sup> Coat	41061	PPG OLYMPIC Premium Interior Water Based Sanding Sealer 41061.
			2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based <b>Polyurethane</b> Clear 42784.
	P13.H	Varnish Flat	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
			1 <sup>st</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
			2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
	P13.I	Varnish Velvet	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
			1 <sup>st</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
			2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
	P13.J	Varnish Semi-Gloss	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
			1 <sup>st</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Polyurethane Clear 42784.
			2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Polyurethane Clear 42784.
	P13.K	Varnish Clear Gloss	Three Coats	42786	PPG OLYMPIC® Premium Interior Water Based Gloss Polyurethane Clear 42786
	P13.L	Stain and Varnish	1 <sup>st</sup> Coat	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
			2 <sup>nd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784
			3 <sup>rd</sup> Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784
	P13.M	Fire Retardant Intumescent Paint (sheen as selected by Architect)	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
			2 <sup>nd</sup> Coat	42-7	PPG Speedhide Interior Fire Retardant Flat Latex 42-7.

				3 <sup>rd</sup> Coat	42-7	PPG Speedhide Interior Fire Retardant Flat Latex 42-7.
		P13.N	Waterborne Epoxy Semi-Gloss	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2 <sup>nd</sup> Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
				3 <sup>rd</sup> Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
(3)	Interior Ferrous Metal	P14.A	Flat Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3 <sup>rd</sup> & 4 <sup>th</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P14.B	Semi-Gloss Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3 <sup>rd</sup> & 4 <sup>th</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P14.C	Eggshell Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3 <sup>rd</sup> & 4 <sup>th</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P14.D	Semi-Gloss Alkyd	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3 <sup>rd</sup> & 4 <sup>th</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.

		P14.E	Waterborne Epoxy Semi-gloss	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
				3 <sup>rd</sup> Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
		P14.F	Aquacrylic Dryfall Semi-gloss Primer & Finish	One Coat	6-724XI	PPG SPEEDHIDE® SUPER TECH® WB Interior 100% Acrylic Dry-Fog Semi-Gloss Latex 6-724XI.
(4)	Interior Galvanized Metal/Aluminum	P15.A	Flat Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P15.B	Semi-Gloss Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3 <sup>rd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P15.C	Eggshell Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3 <sup>rd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P15.D	Semi-Gloss Alkyd	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3 <sup>rd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
		(5)	Interior Plaster,	P16.A	Flat Latex	1 <sup>st</sup> Coat

	Concrete, Brick, Stucco			2 <sup>nd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.		
				3 <sup>rd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.		
				P16.B	Semi-Gloss Latex	1 <sup>st</sup> Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801
		2 <sup>nd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.				
		3 <sup>rd</sup> Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.				
		P16.C	Eggshell Latex	1 <sup>st</sup> Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801		
		2 <sup>nd</sup> Coat		12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series			
		3 <sup>rd</sup> Coat		12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.			
		P16.D	Semi-Gloss Alkyd	1 <sup>st</sup> Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801		
		2 <sup>nd</sup> Coat		6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.			
		3 <sup>rd</sup> Coat		6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.			
		(6)	Interior Concrete Block	P17.A	Flat latex	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
						2 <sup>nd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
						3 <sup>rd</sup> Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
				P17.B	Semi-Gloss Latex	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
2 <sup>nd</sup> Coat	12-510					PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.		
3 <sup>rd</sup> Coat	12-510					PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.		

		P17.C	Eggshell Latex	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2 <sup>nd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3 <sup>rd</sup> Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P17.D	Semi-Gloss Alkyd	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2 <sup>nd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3 <sup>rd</sup> Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
(7)	Interior Acoustical Ceiling Tile/Plaster	P18.A	Latex	One Coat to Cover	14-110	PPG MULTI-PRO™ Interior Flat Latex Wall & Ceiling Paint 47-110 Series.

### B. Exterior

(1)	Exterior Plaster, Concrete	P50.A	Flat, Acrylic Emulsion	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2 <sup>nd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P50.B	Low Sheen Enamel Acrylic	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2 <sup>nd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P50.C	Flat Latex	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2 <sup>nd</sup> Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
		P50.D X	Elastomeric (Smooth) 5 yr. warranty	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2 <sup>nd</sup> Coat	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
				Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
		P50.E	Elastomeric (Medium)	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.

			Aggregate) 5 yr. warranty	2 <sup>nd</sup> Coat	4-60	PPG PERMA-CRETE® Medium Texture
		P50.F	Elastomeric (Coarse Aggregate) 5 yr. warranty	1 <sup>st</sup> Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2 <sup>nd</sup> Coat	4-70	PPG PERMA-CRETE® Coarse Texture
(2)	Exterior Concrete Block	P51.A	Flat, acrylic emulsion	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2 <sup>nd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
				3 <sup>rd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P51.B	Flat Latex	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2 <sup>nd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
				3 <sup>rd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P51.C	Elastomeric (Smooth) 5 Yr. warranty	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2 <sup>nd</sup> Coat	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
				Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
	P51.D	Elastomeric (Medium Aggregate) 5 yr warranty	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.	
			2 <sup>nd</sup> Coat	4-60	PPG PERMA-CRETE® Medium Texture	
	P51.E	Elastomeric (Coarse Aggregate) 5yr warranty	1 <sup>st</sup> Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.	
			2 <sup>nd</sup> Coat	4-70	PPG PERMA-CRETE® Coarse Texture	
Exterior Masonry	P51.F	Clear Water Repellent	One Coat	4-6200	PPG PERMA-CRETE® Plex-Seal™ WB Interior/Exterior Clear Sealer 4-6200.	
(3)	Exterior Wood	P53.A	Flat Acrylic Emulsion	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2 <sup>nd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.

			3 <sup>rd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.	
P53.B	Flat Latex	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.		
		2 <sup>nd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)		
		3 <sup>rd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)		
P53.C	Semi-Gloss Acrylic	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.		
		2 <sup>nd</sup> Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.		
		3 <sup>rd</sup> Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.		
P53.D	Low Sheen Enamel Acrylic	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.		
		2 <sup>nd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)		
		3 <sup>rd</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)		
P53.E	Gloss; Alkyd Enamel	1 <sup>st</sup> Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.		
		2 <sup>nd</sup> Coat	6-1610	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Gloss 6-1610 Series.		
		3 <sup>rd</sup> Coat	6-1610	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Gloss 6-1610 Series.		
P53.F	Flat, Stain Oil Base Semi-Transparent	Two Coats	77-1460	PPG SUN-PROOF Deck, Fence, Siding Semi-Transparent Stain 77-1460.		
P53.G	Flat, Stain Opaque	Two Coats	77-1110	PPG SUN-PROOF Deck, Fence, Siding Solid Color Latex Stain 77-1110 Series		
(4)	Exterior Ferrous Metal	P55.A	Flat Acrylic	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.

			2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			3 <sup>rd</sup> & 4 <sup>th</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.	
	P55.B	Flat Latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			3 <sup>rd</sup> & 4 <sup>th</sup> Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)	
	P55.C X	Semi-Gloss	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			3 <sup>rd</sup> & 4 <sup>th</sup> Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.	
	P55.D	Gloss	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			3 <sup>rd</sup> & 4 <sup>th</sup> Coat	90-1310	PPG Pitt-Tech® Plus Interior/Exterior High Gloss DTM Industrial Enamel 90-1310 Series.	
	P55.E	Elastomeric	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			2 <sup>nd</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
			Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.	
(5)	Exterior Galvanized Metal	P56.A	Flat, Acrylic Emulsion	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P56.B	Flat, latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus

					Interior/Exterior DTM Industrial Primer 90-912 Series.	
		2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	76-45 76-110		PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)	
P56.C	Semi-Gloss	1 <sup>st</sup> Coat	90-912		PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
		2 <sup>nd</sup> & 3 <sup>rd</sup> Coat	78-45		PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.	
P56.D	Gloss	1 <sup>st</sup> Coat	90-912		PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
		2 <sup>nd</sup> Coat	90-912		PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
		3 <sup>rd</sup> & 4 <sup>th</sup> Coat	90-1310		PPG Pitt-Tech® Plus Interior/Exterior High Gloss DTM Industrial Enamel 90-1310 Series.	
P56.E X	Elastomeric	1 <sup>st</sup> Coat	90-912		PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.	
		2 <sup>nd</sup> Coat	4-110		PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.	
		Spray Application	4-110		PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.	
(6)	Exterior Aluminum	P58.A	Flat, Acrylic Emulsion	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
				3 <sup>rd</sup> Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P58.B	Flat, latex	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
				3 <sup>rd</sup> Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
		P58.C	Semi-Gloss Enamel	1 <sup>st</sup> Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2 <sup>nd</sup> Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss

					Acrylic Latex 78-45 Series.
				3 <sup>rd</sup> Coat	78-45 PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.

END OF SECTION

## SECTION 224000 - PLUMBING

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. Provide and install all required connections to existing systems as required by the plans and specifications. Integrate existing systems with all new work to provide a complete working system. The work includes, but is not necessarily limited to, the following:

1. Drain system, including condensate drain.
2. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.

- B. Work Specified Elsewhere:

1. Section 230010 "General Mechanical Provisions"
2. Section 237000 "HVAC Equipment"
3. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in Division 26 Electrical, unless otherwise noted.
4. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
5. Painting unless specifically called for in the drawings or specifications.
6. Carpentry.

#### 1.3 QUALITY ASSURANCE:

- A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with NSF 14 "Plastics Piping Systems Components and Related Materials" for plastic piping specialty components.
- E. Comply with NSF 61 Annex G for materials for water service piping and specialties for domestic water.

- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC by a qualified testing agency, and marked for intended location and application.
- G. Welder Qualifications: Welders shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified welder shall bear evidence of current certification thirty (30) days before commencing work on project.
- H. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

## PART 2: PRODUCTS

### 2.1 PIPING MATERIALS:

- A. Drain Piping, Including Condensate:
  1. Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron threaded fittings, ANSI B16.3.
  - or-
  2. Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2" to 2") or "Lead Free" bronze (2-1/2" to 4") press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. ProPress.
  3. Inside Building, Exposed to View: Brass with polished chrome plate finish.
- B. Piping Specialties: All water piping specialties shall meet the California "Lead Free" standard for domestic water service.
  1. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
  2. Union:
    - a. 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Unions for copper piping shall be copper or cast bronze. Anvil.
  3. Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO, Zurn Wilkins Series DUXL.
- C. Miscellaneous Piping Items:
  1. Pipe Identification:
    - a. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.
    - b. Detectable Warning Tape, Below Grade Piping: Preprinted with a description of underground utility, color coded, a minimum of 6" wide and 4 mils thick, metallic ribbon marker capable of being located with a metal detector. Christy, Seton.

2. Pipe Support: Finish shall be galvanized, unless noted otherwise.
  - a. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Anvil, B-Line, Tolco, Unistrut.
  - b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph "a" above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
  - c. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.
  - d. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.
    - (1) Copper Pipe System: Pipe clamp with locknut and thermoplastic elastomer cushion. Cush-A-Clamp.
  - e. Pipe Riser Clamp: Galvanized finish. Anvil, B-Line, Tolco, Unistrut.
  - f. Pipe Block: 100% recycled rubber pad with reflective strips on each side, UV resistant, 1" gap between multiple block systems, 12 gage galvanized strut channel bolted to block, adjustable hinge fitting for sloped roofs. B-Line DB6 series.
3. Flashing: Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials.
  - a. Pipe Through Roof: Flashing shall be prefabricated galvanized steel roof jacks with 18 inch square base flange, minimum 24 gage. Oatey All-Flash.
4. Protection for Underground Piping:
  - a. Ferrous Pipe and Fittings, Below Grade: Polyethylene encasement, minimum 8 mils thick, ANSI/AWWA C105/A21.5. Polywrap.
  - or-
  - b. Ferrous Pipe, Below Grade: Factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. X-Tru-Coat, Scotchkote.
  - c. Ferrous Pipe Fittings, Below Grade: Polyvinyl tape, 10 mils thickness. Johns-Manville.
5. Tracer Wire: Minimum 14 AWG copper, corrosion resistant polyethylene insulated for direct burial, color coated per APWA Uniform Color Code. Agave Wire, Southwire.
6. Escutcheons: Chrome plated, metal type with fasteners.

## PART 3: EXECUTION

### 3.1 PIPING INSTALLATION:

- A. General: Piping layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.
1. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.
  2. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.
  3. Piping shall be installed in a manner to ensure unrestricted flow, free of sags and bends, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.
  4. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Minimum pipe size shall be 3/4", unless otherwise noted. Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used. Reducing size of piping in direction of flow is prohibited.
  5. All joints, changes in direction, and branch connections shall be made with standard fittings. Close nipples shall not be used. Connect branch piping and risers from top of horizontal piping.
  6. Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions.
  7. A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
  8. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.
  9. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
  10. Protection For Underground Piping:
    - a. All ferrous piping below grade shall be encased in polyethylene tube.  
-or-
    - b. All ferrous piping below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6" above surrounding grade.
    - c. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6" above surrounding grade.
    - d. All ferrous pipe fittings and areas of damaged coating shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils.
  11. Below Grade:
    - a. Install underground piping buried at least 24 inches below finished grade.

- b. Plastic Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.
  - (1) Secure insulated tracer wire to underground pipe with nylon ties at maximum 10 feet interval. Tracer wire shall terminate 6" above grade at both ends of piping. Tracer Wire is in addition to preprinted metallic detectable warning tape.
- d. Detectable Warning Tape: Bury a continuous, preprinted, color coded, metallic detectable warning tape capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

12. Above Grade:

- a. Vertical lines shall be installed to allow for building settlement without damage to piping.
- b. Provide access doors as required where equipment, piping, valves, etc. are not otherwise accessible. Deliver doors to the General Contractor for installation.
- c. Only equipment mounted on vibration isolators shall be connected with flexible connectors.
- d. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
- e. Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
- f. Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
- g. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.
- h. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - (1) Near each valve.
  - (2) Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
  - (3) Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - (4) At access doors and similar access points that permit view of concealed piping.
  - (5) Near major equipment items and other points of origination and termination.
  - (6) Space at maximum intervals of 20 feet along each run.
- j. Hanger and Support Installation:
  - (1) Install seismic restraints on piping in compliance with CBC Chapter 16A.

- (2) Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.
  - (3) All piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.
  - (4) Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
  - (5) Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.
  - (6) Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.
  - (7) Provide additional supports for fittings and couplings.
  - (8) Support pipe within 12" of all changes in direction.
13. Electrical Equipment: Piping shall not pass above electrical panels, motor control centers or switchboards.

B. Piping Joint Construction:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
3. Copper Tubing, Pressure Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure seal fitting manufacturer.
4. Threaded Joints: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
6. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
7. Flanged Joints: Install gasket material, size, type, and thickness appropriate for water service. Install gasket concentrically positioned.
8. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

C. Drain Piping, Including Condensate: Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide secondary drain piping where required.

1. Provide trap at each air handling unit to prevent air leakage.
2. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass, except in equipment rooms, piping shall be galvanized steel.

3. Gravity drain piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated below:
  - a. Install pipe support for horizontal steel piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.
    - (1) 3/4" to 1-1/4": Maximum span, 7 feet; minimum rod size, 3/8".
    - (2) 1-1/2" to 2": Maximum span, 9 feet; minimum rod size, 3/8".
  - b. Install support for vertical steel piping at each floor, not to exceed 10 feet.
  - c. Install pipe support for horizontal copper piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.
    - (1) 1/2" to 1-1/4": Maximum span, 6 feet; minimum rod size, 3/8".
    - (2) 1-1/2" to 2": Maximum span, 8 feet; minimum rod size, 3/8".
  - d. Install support for vertical copper piping at each floor, not to exceed 10 feet.

### 3.2 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.
- B. Gravity Systems:
  1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
  2. Drains, Including Condensate: Similar to Sanitary Sewer.

END OF SECTION

## SECTION 230010 – GENERAL MECHANICAL PROVISIONS

### PART 1: GENERAL

#### 1.1 GENERAL CONDITIONS:

- A. The preceding General and Special Conditions and Divisions 00 and 01 requirements shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall apply to all of the Sections of Divisions 22 and 23 of these Specifications and shall be considered a part of these sections.

#### 1.2 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

1. California Code of Regulations (CCR):
  - a. Title 8, Industrial Relations
  - b. Title 17, Public Health
  - c. Title 20, Section 1601 et seq., Appliance Efficiency Regulations
  - d. Title 24, Part 1, Administrative Code
2. California Building Code – CBC – 2019
3. California Electrical Code – CEC – 2019
4. California Mechanical Code – CMC – 2019
5. California Plumbing Code – CPC – 2019
6. California Energy Code – CEEC – 2019
7. California Fire Code – CFC – 2019
8. California Green Building Standards Code – CAL Green – 2019
9. Air Diffusion Council – ADC
10. American Gas Association – AGA
11. Air Conditioning, Heating and Refrigeration Institute – AHRI
12. Air Movement and Control Association – AMCA
13. American National Standards Institute – ANSI
14. American Society of Heating, Refrigerating, and Air Conditioning Engineers – ASHRAE
15. American Society of Mechanical Engineers – ASME
16. American Society for Testing and Materials – ASTM
17. American Water Works Association – AWWA
18. Cast Iron Soil Pipe Institute – CISPI
19. National Electrical Manufacturers Association – NEMA
20. National Fire Protection Association – NFPA
21. National Sanitation Foundation – NSF
22. Occupational Safety and Health Act – OSHA
23. Plumbing and Drainage Institute – PDI
24. Sheet Metal and Air Conditioning Contractors National Association – SMACNA
25. Underwriters' Laboratory – UL
26. Local Codes
27. Bakersfield City School District Standards

1.3 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.4 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements. Verify the proper voltage and phase of all equipment with the electrical plans. If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination.

1.5 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Architect. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

1.6 QUIETNESS:

- A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.7 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.8 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.9 COMPATIBILITY WITH EXISTING SYSTEMS:

- A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

#### 1.10 MATERIALS AND EQUIPMENT:

- A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.
- B. All duct and other related air distribution openings shall be covered, during installation, with tape, plastic, sheet metal or other metals acceptable to the enforcement agency to reduce the amount of dust, water and debris which may enter the system.

#### 1.11 SUBMITTALS:

- A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution.

Each specification section shall be submitted separately. All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Include manufacturer's catalog data of each manufactured item. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.
2. All shop drawings shall be submitted in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.
4. Electronic submittals, where allowed by Division 01, are acceptable provided the following requirements are met. Electronic submittals which do not comply with these requirements will be rejected.
  - a. Submittal shall be in PDF format, with bookmarks for table of contents and each tab, and sub-bookmarks for each item.
  - b. All text shall be searchable, except for text that is part of a graphic.
  - c. Submittal shall include all items noted in paragraphs 1 through 3 above, except a binder is not required.
  - d. Electronic submittals shall be processed through normal channels. Do not submit directly to the Engineer.
  - e. Contractor shall provide Owner and Owner's Representative with hard copies of the final submittal. Coordinate exact number required with Owner through Architect/Engineer.

- B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Where equipment is scheduled on the drawings, any equipment submitted other than scheduled equipment is considered a substitution. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. A completed and signed Substitution Request form shall be included. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.
- C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

#### 1.12 DELIVERY, STORAGE, AND HANDLING:

- A. Proper implements, tools and facilities shall be provided and used for unloading and distributing materials along the line of the work. Any pipe, fitting, etc. damaged in transportation or handling, shall be rejected and immediately removed from the job site.
- B. Contractor shall be responsible for the safe storage of all material intended for the work. Contractor shall take all necessary precautions to prevent damage to materials, equipment and work.
- C. Any pipe joint compound, liquid or cementitious materials, etc. shall be stored in their manufacturer's original containers and shall be kept free from moisture and protected from damage.
- D. All pipe, fittings, valves, etc. shall be delivered in their original shipping containers with labels in place, and shall be stored in such a manner as to protect them from snow, ice, mud, and water intrusion.

#### 1.13 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.14 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.15 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Architect.

1.16 EXCAVATION AND BACKFILL:

- A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.
- B. Excavation: Width of trenches at top of pipe shall be minimum of 16", plus the outside diameter of the pipe or pipe insulation. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.
- C. Backfill:
  - 1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator. Native soil may be used where allowed by Geotechnical (Soils) Report. Where native soil is used, trenching for gravity drain pipe shall be done using a laser-level and trencher.
  - 2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.
- D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100 feet of trench.

1.17 PROTECTION FOR UNDERGROUND PIPING:

- A. All ferrous piping below grade (except cast iron) shall be encased in polyethylene tube, minimum 8 mil thick, ANSI/AWWA C105/A21.5. Polywrap.
- or-
- B. All ferrous piping below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6" above surrounding grade. Scotchkote, X-Tru-Coat.
- C. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6" above surrounding grade. Johns-Manville.
- D. All fittings and areas of damaged coating shall be covered with two layers, double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Johns-Manville.

1.18 ACCESS DOORS:

- A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Key and cylinder lock, except quick opening type for Emergency Gas Shutoff Valve. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"
Fire/smoke damper (FSD)	20" x 24"

1.19 HOUSEKEEPING PAD:

- A. Housekeeping pads shall be minimum 6" high concrete, 3000 PSI compressive strength, unless otherwise noted. Pad shall extend 6" beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the pad shall have a 3/4" chamfer. The pad shall have #4 reinforcing bars at 12" on center, each way, located at the mid-depth of the pad. If not poured at the same time as the floor slab with pad rebar tied to floor rebar, the pad shall be anchored as follows: Drill 1" diameter, 4" deep hole in floor. Fill hole with "Por-Rok", then insert 8" long, #4 rebar into hole. Provide a minimum of 4 of these anchors per pad, but no more than 4 feet apart in either direction. Anchor points shall be 12" from the edge of the pad.

1.20 CONCRETE ANCHORS:

- A. Steel bolt with expansion anchor requiring a drilled hole - powder driven anchors, adhesive anchors and concrete screws are not acceptable. Reuse of screw anchor holes shall not be permitted. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete. Post-installed anchors in concrete used for component anchorage shall be prequalified for seismic application in accordance with ACI 355.2 and ICC-ES AC193. Post-installed anchors in masonry used for component anchorage shall be prequalified for seismic applications in accordance with ICC-ES AC01. Maximum allowable stresses for tension and shear shall be 80% of the ICC-ES test report values. Hilti, ITW Red Head.

1.21 EQUIPMENT ANCHORING:

- A. All equipment shall be securely anchored in accordance with ASCE 7-16, Chapter 13, as amended by CBC Section 1617A.1. All equipment mounted on concrete shall be secured with a concrete anchor as specified above at each mounting point.

1.22 SUPPORTS AND SEISMIC RESTRAINTS:

- A. All mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the "Seismic Restraint Systems" latest edition, as published by Tolco, OPM-0052-13, or other HCAI pre-approved system, and in accordance with ASCE 7-16, Chapter 13, as amended by CBC Section 1617A.1. Brace spacing shall be reduced by 50% for cast iron, plastic, no-hub, or other non-ductile piping. A copy of this manual shall be kept on site at all times during construction.

1.23 ASBESTOS CONTAINING MATERIALS AND ASBESTOS REMOVAL:

- A. No materials or material coatings containing asbestos shall be allowed on this project.
- B. All asbestos removal shall be by Owner. Asbestos is to be removed before the work is started. If the Contractor discovers asbestos which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.24 SYSTEM IDENTIFICATION:

- A. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 2" high lettering minimum, white on black background. Contact type permanent adhesive, compatible with label and with substrate. Nameplates shall be permanently secured to the exterior of the unit. Seton.
- B. Below Grade Piping:
  - 1. Detectable Warning Tape: Bury a continuous, pre-printed with a description of underground utility, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. The detectable warning tape shall be a minimum of 6" wide and 4 mils thick. Locate directly over buried pipe, 6" to 8" below finished grade. Christy, Seton.
  - 2. Tracer Wire: Secure 14 AWG minimum, corrosion resistant insulated tracer wire, to underground PVC/plastic pipe with nylon ties at maximum 10 feet interval. Terminate tracer wire 6" above grade at each end of piping.
- C. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, indicate the fluid conveyed or its abbreviation, by pre-printed markers, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 20 feet maximum intervals along exposed portions of lines.

1.25 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.
- B. At end of each work day, the Contractor shall cover all open ends of piping and ductwork with protective plastic.

1.26 ACCEPTANCE TESTING:

- A. The Contractor shall perform, document and submit all acceptance testing as required by California Code of Regulations, Title 24, and as noted on the Certificate of Compliance form, where applicable. Submit a copy of the documentation to the Engineer for review, prior to submitting to Administrative Authority.

1.27 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included with factory support contact names and phone numbers.
- B. USB Flash Drive: The Contractor shall provide three copies of USB flash drives containing the Operations and Maintenance Instructions and Wiring Diagrams as instructed per above requirements in PDF format.
- C. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation, maintenance, and troubleshooting of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system, including but not limited to, programming and setup of any control systems. The Engineer's office shall be notified 48 hours prior to this meeting.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, compact discs, and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.28 RECORD DRAWINGS:

- A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, sidewalks. In addition, the water, gas, sewer, underfloor duct, etc. within the building shall be recorded by offset distances from building walls. The Contractor shall have a set of reproducible drawings made from the original drawings as part of his overhead expense. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings, marked-up prints, and reproducible drawings, shall be submitted to the Engineer for review.

PART 2: PRODUCTS (not used)

PART 3: EXECUTION (not used)

END OF SECTION

## SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Provide the services of an independent test and balance agency to test, adjust and balance, retest and record performance of the system(s) to obtain design quantities as specified. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report. The work includes, but is not necessarily limited to, the following:
  - 1. Balance air systems.
  - 2. Testing, adjusting, and balancing equipment.
  - 3. Control system verification
- B. Work Specified Elsewhere:
  - 1. Section 230010 “General Mechanical Provisions”
  - 2. Section 230700 “HVAC Insulation”
  - 3. Section 232300 “Refrigerant Piping System”
  - 4. Section 233113 “Air Distribution”
  - 5. Section 237000 “HVAC Equipment”

#### 1.3 DEFINITIONS:

- A. Adjusting: Varying of system flow by modifying settings of dampers, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.
- B. Balancing: Proportioning of air flows through system mains, branches, and terminal devices using standardized procedures to obtain specified air flow while imposing the least amount of restriction on the HVAC system.
- C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air flow in velocities or quantities used in evaluating the performance of a HVAC system.

#### 1.4 QUALITY ASSURANCE:

- A. Contractor Qualifications:
  - 1. Prior to commencing work, the agency shall be reviewed by the Engineer and shall be certified by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing Adjusting and Balancing Bureau (TABB). Certification shall be current for the duration of the project.

2. The Testing, Adjusting, and Balancing (TAB) Contractor shall be an independent agency specializing in the testing, adjusting, and balancing of HVAC systems and associated equipment. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report.
3. The TAB Contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

#### 1.5 SUBMITTALS:

- A. Include in shop drawings copies of forms to be used for testing and balancing showing all data which is to be recorded.
- B. Three copies of completed balance report shall be submitted to and reviewed by the Mechanical Engineer prior to the final mechanical construction review.

#### 1.6 WARRANTY:

- A. Provide warranty for period of 120 days following submission of completed report, during which time the Engineer, at his discretion, may request a recheck or resetting of any item(s) in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

### PART 2: PRODUCTS

#### 2.1 INSTRUMENTS AND TOOLS:

- A. TAB Contractor shall furnish all labor, tools, and instruments as required to achieve a full and effective balance of the HVAC systems.
- B. All instruments used for measurements shall be accurate, and calibration histories for each instrument shall be available for examination. Application of instrumentation shall be in accordance with AABC, NEBB, or TABB standards.
- C. Instruments that require calibration shall have unexpired calibration dates. Instruments shall be calibrated against certified equipment having a known valid relationship to nationally recognized standards. If no national standard exists, the basis for calibration shall be documented and submitted in the final report.
- D. Certified documentation of all instrument calibrations shall be submitted in the final report.

#### 2.2 BELTS, SHEAVES, IMPELLERS:

- A. TAB Contractor shall coordinate with the HVAC Contractor to supply correctly sized drive belts and sheaves. HVAC Contractor shall make any changes in pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by TAB Contractor, at no additional cost to Owner. Impellers shall be trimmed or replaced by the HVAC Contractor and shall be correctly re-sized and coordinated by the TAB Contractor.
- B. TAB Contractor shall determine the fan belt and sheave replacement necessary for final balance condition for specified air quantity when the VFD is operating in the bypass mode for final field conditions, without placing the motor over its nameplate amp rating.

## PART 3: EXECUTION

### 3.1 EXAMINATION:

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purposes and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201 "Fans and Systems", or in SMACNA's "HVAC Systems – Duct Design". Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Examine and verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees upward deflection, unless noted otherwise. Make a notation of any that are not set properly.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated valves.

### 3.2 PREPARATION:

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminal devices installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature control systems are operational.
    - h. Ceilings are installed.
    - j. Windows and doors are installed.
    - k. Suitable access to balancing devices and equipment is provided.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING:

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems – Testing Adjusting, and Balancing", and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233113 "Air Distribution".
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "HVAC Insulation".
- C. Mark equipment and balancing devices, including damper control positions, valve position indicators, fan speed control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Measure and report testing and balancing measurements in inch-pound units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS:

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of equipment showing exactly where all pressure readings were taken.
- C. Prepare schematic diagrams of systems' "as-built" duct layouts. Identify each grille, diffuser, and register as to its location.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- J. Check for airflow blockages.
- K. Check condensate drains for proper connections and functioning.
- L. Check for proper sealing of air handling unit components.
- M. Verify that air duct system is sealed as specified in Section 233113 "Air Distribution".

### 3.5 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS:

- A. Adjust fan(s) to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside air, return air, and relief air dampers for proper position that simulates minimum outdoor air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air handling system.

- d. Report artificial loading of filters at the time static pressures are measured.
3. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan motor amperage to ensure that no overload occurs. Measure amperage in full cooling, full heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.
1. Measure airflow of sub-main and branch ducts.
  2. Adjust sub-main and branch duct volume dampers for specified airflow.
  3. Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure inlets and outlets airflow.
  3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Re-adjust to design if necessary.
  2. Re-measure and confirm that total airflow is within design.
  3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record minimum and maximum outside and exhaust airflows.
  6. Measure and record all operating data.
  7. Record final fan performance data.
  8. Measure and record final pressure drop across filter(s) at each filter bank. Record filter quantity and size(s) at each filter bank.
  9. Measure and record unit entering and leaving air temperatures: DB heating, DB and WB cooling.

### 3.6 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Phase and hertz.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Full load amperes.
  8. Starter size and thermal protection element rating.
  9. Service factor and frame size.
- B. Motors Driven by Variable Frequency Controllers: Test manual bypass of controller to prove proper operation.

### 3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure and record entering and leaving air temperatures.
- C. Record fan and motor operating data.

### 3.8 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
  - 1. Verify temperature control system is operating within the design limitations.
  - 2. Confirm that the sequences of operation are in compliance with Contract Documents.
  - 3. Verify that controllers are calibrated and function as intended.
  - 4. Verify that controller set points are as indicated.
  - 5. Verify the operation of lockout or interlock systems.
  - 6. Verify the operation of damper actuators.
  - 7. Verify that controlled devices are properly installed and connected to correct controller.
  - 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
  - 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Set, test and adjust packaged air conditioning unit economizer and demand control ventilation operation in cooperation with Controls Contractor. Record minimum and maximum outside and exhaust airflows.
- C. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.9 TOLERANCES

- A. Set HVAC system's airflow rates within the following tolerances:
  - 1. Supply, return, and exhaust fans and equipment with fans: Plus 10%, minus 0% of design requirements.
  - 2. Air outlets and inlets: Plus 10%, minus 0% of design requirements.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.10 PROGRESS REPORTING

- A. Initial Construction Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: Prepare bi-weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.11 FINAL REPORT

- A. General: Prepare a certified written report for new systems; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturer's test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB Contractor.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor, return, and exhaust air dampers.
    - b. Conditions of filters.
    - c. Cooling coils, wet and dry bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable air volume systems.

- g. Settings for supply air, static pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single line diagram and include the following:
  - 1. Quantities of outdoor, supply, return, and exhaust airflows.
  - 2. Duct, outlet, and inlet sizes.
  - 3. Balancing stations.
  - 4. Position of balancing devices.
- E. Air Handling Unit Test Reports: For air handling units with coils, include the following:
  - 1. Unit Data:
    - a. Unit Identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center to center dimensions of sheave and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center to center dimensions of sheave and amount of adjustments in inches.
  - 3. Test Data, Indicated and Actual Values:
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static pressure differential in inches wg.
    - f. Cooling/heating coil static pressure differential in inches wg.
    - g. Outdoor airflow cfm.
    - h. Return airflow cfm.
    - j. Outdoor air damper position.
    - k. Return air damper position.
    - l. Vortex damper position.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
  - a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and size.
  - e. Manufacturer's serial number.
  - f. Arrangement and class.
  - g. Sheave make, size in inches, and bore.
  - h. Center to center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
  - a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center to center dimensions of sheave, and amount of adjustments in inches.
  - g. Number, make, and size of belts.
3. Test Data, Indicated and Actual Values:
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.

G. Round, Flat Oval, and Rectangular Duct Traverse Reports: Include a diagram with grid representing the duct cross section and record the following:

1. Report Data:
  - a. System and air handling unit number.
  - b. Location and zone.
  - c. Traverse air temperature in deg F.
  - d. Duct static pressure in inches wg.
  - e. Duct size in inches.
  - f. Duct area in square feet.
  - g. Indicated airflow in cfm.
  - h. Indicated velocity in fpm.
  - i. Actual airflow rate in cfm.
  - j. Actual average velocity in fpm.
  - k. Barometric pressure in psig.

H. Air Terminal Device Reports:

1. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.

2. Unit Data:
  - a. System and air handling unit identification.
  - b. Location and size.
  - c. Apparatus used for test.
  - d. Area served.
  - e. Make.
  - f. Number from system diagram.
  - g. Type and model number.
  - h. Size.
  - i. Effective area in square feet.

3. Test Data, Indicated and Actual Values:
  - a. Airflow rate in cfm.
  - b. Air velocity in fpm.
  - c. Preliminary airflow rate as needed in cfm.
  - d. Preliminary velocity as needed in fpm.
  - e. Final airflow rate in cfm.
  - f. Final velocity in fpm.
  - g. Space temperature in deg F.

J. Instrument Calibration Reports:

1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.12 VERIFICATION OF TAB REPORT

- A. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of a representative of the Architect.
- B. Prepare test and inspection reports.

END OF SECTION

## SECTION 230700 – HVAC INSULATION

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
  - 1. Ductwork insulation system.
  - 2. Refrigerant piping insulation system.
  - 3. All material and equipment as shown or noted on the drawings or as specified.
  - 4. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, supports and related items no longer required.
- B. Work Specified Elsewhere:
  - 1. Section 230010 “General Mechanical Provisions”
  - 2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
  - 3. Section 232300 “Refrigerant Piping System”
  - 4. Section 233113 “Air Distribution”
  - 5. Section 237000 “HVAC Equipment”

#### 1.3 QUALITY ASSURANCE:

- A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.
- B. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

### PART 2: PRODUCTS

#### 2.1 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Fiberglass Blanket: Installed thermal resistance at a mean temperature of 75F shall meet or exceed indicated R-value. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 75F. 1-1/2 pound per cubic foot density. 1-1/2” thickness, R-6 where ductwork is within the building thermal insulation envelope. 2” thickness, R-8 where ductwork is outside the building thermal insulation envelope and/or above the roof. Faced with glass reinforced foil laminated to Kraft paper. CertainTeed SoftTouch, Johns Manville Microlite XG, Knauf, Owens Corning SOFTR.

## 2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Johns Manville Zeston.
- C. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide prefabricated aluminum strapping and seals by same manufacturer. ITW Pabco/Childers, RPR Products.
- D. Foamed Plastic: Closed cell or rubber based, preformed flexible elastomeric pipe insulation, ASTM C534 Type I. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 75F. Provide adhesive by same manufacturer. Armacell AP/Armaflex.
- E. Elastomeric Insulation Adhesive: Black, low VOC air-drying contact adhesive. Armacell Armaflex 520 BLV.

## PART 3: EXECUTION

### 3.1 DUCTWORK INSULATION INSTALLATION:

- A. General: Insulate all sheet metal supply, return, and outside air intake ductwork except as noted below. Insulation shall be continuous through walls and floors except at fire dampers.
- B. Where Insulation Is Not Required: Do not insulate factory-insulated ducts or casings, acoustic lined ducts, fibrous glass ducts, underground ductwork, supply or return ductwork exposed to view in the space that it serves, or exhaust ductwork.
- C. Concealed Ductwork: Wrap concealed ductwork with fiberglass blanket lapped 2" minimum. Secure with staples 4" on centers maximum on straight runs and 3" maximum at elbows and fittings. Insulation on bottom of ducts wider than 36" shall also be secured with mechanical fasteners at 24" on center.

### 3.2 PIPING INSULATION INSTALLATION:

- A. Refrigerant Piping: Cover piping, suction and liquid lines, with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves and connections. Piping exposed to view shall be covered with PVC jacketing. Piping exposed to weather shall be covered with aluminum jacketing, seal all joints and seams with gray outdoor mastic or silver silicone sealant.
  - 1. Less Than 1-1/2": 1/2" thickness, minimum.
  - 2. 1-1/2" and Larger: 1" thickness, minimum.

END OF SECTION

## SECTION 232300 – REFRIGERANT PIPING SYSTEM

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
  - 1. Refrigeration system.
  - 2. All material and equipment as shown or noted on the drawings or as specified.
  - 3. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, supports and related items no longer required.
- B. Work Specified Elsewhere:
  - 1. Section 230010 “General Mechanical Provisions”
  - 2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
  - 3. Section 230700 “HVAC Insulation”
  - 4. Section 237000 “HVAC Equipment”
  - 5. Connection of condensate drain(s) to equipment.
  - 6. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
  - 7. Painting unless specifically called for in the drawings or specifications.

#### 1.3 QUALITY ASSURANCE:

- A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.
- B. Brazier Qualifications: Brazers shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified brazer shall bear evidence of current certification thirty (30) days before commencing work on project.
- C. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

### PART 2: PRODUCTS

#### 2.1 PIPE AND FITTINGS:

- A. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped. Wrought copper fittings, silver alloy brazed, 1100F, Silfos. Size 3/8" and smaller shall be refrigerant tube, ASTM B280.

## 2.2 VALVES:

- A. General: Valves shall meet the standard for refrigerant service. Manufacturer's model numbers are listed to complete description. All valves of a particular type or for a particular service shall be by the same manufacturer.
- B. Line Valves: Bronze body construction, full port ball type for refrigerant service, TFE locked in seals. Back seated valve stem.
- C. Solenoid Valve: Full line size. Sporlan.

## 2.3 PIPING SPECIALTIES:

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Unions, 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Anvil.
- C. Filter Drier: Replaceable core. Capacity in accordance with AHRI Standard 710. Sporlan Catch-All.
- D. Moisture Indicator Sight Glass: Double port. Sporlan See-All, Henry.
- E. Suction Line Accumulator:
- F. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered, suitable for system pressure. US Hose, Senior Flexonics.
- G. Escutcheons: Chrome plated, metal type with fasteners.

## 2.4 MISCELLANEOUS PIPING ITEMS:

- A. Piping Identification:
  - 1. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.
- B. Pipe Support: Finish shall be galvanized, unless noted otherwise.
  - 1. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Anvil, B-Line, Tolco, Unistrut.
  - 2. Insulation Support: Calcium silicate insulation, 100 PSI, or heavy density fiber glass, 100 PSI. Insulation thickness equal to adjoining pipe insulation. Steel support shield or saddle. Provide vapor barrier for chilled water piping. Insulation and/or vapor barrier shall extend 1" beyond steel support. Pipe hanger in accordance with paragraph "1" above. Increase hanger size per manufacturer's recommendation. B-Line, Insulated Pipe Shields, Inc., Uni-Grip.
  - 3. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph "1" above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
  - 4. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.

5. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.
    - a. Copper Pipe System: Pipe clamp with locknut and thermoplastic elastomer cushion. Cush-A-Clamp.
  6. Pipe Riser Clamp: Galvanized finish. Anvil, B-Line, Tolco, Unistrut.
  7. Pipe Block: 100% recycled rubber pad with reflective strips on each side, UV resistant, 1" gap between multiple block systems, 12 gage galvanized strut channel bolted to block, adjustable hinge fitting for sloped roofs. B-Line DB6 series.
- C. Flashing: Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials.
1. Pipe Through Roof: Flashing shall be prefabricated galvanized steel roof jacks with 18 inch square base flange, minimum 24 gage. Oatey All-Flash.

### PART 3: EXECUTION

#### 3.1 PIPING INSTALLATION:

- A. Plumbing layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.
- B. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.
- C. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.
- D. Piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.
- E. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
- F. All joints, changes in direction, and branch connections shall be made with standard fittings. Close nipples shall not be used. When using pre-charged tubing, all changes of direction shall be made with bending tools producing neat uniform bends. Free hand bends will not be accepted.
- G. Install liquid line filter drier on each refrigerant circuit.
- H. Install a moisture indicator sight glass, full line size, downstream of all filter dryers.
- J. A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
- K. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

L. Open ends of piping shall be capped during progress of work to preclude foreign matter.

M. Inside Building:

1. Vertical lines shall be installed to allow for building settlement without damage to piping.
2. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
3. Pipe Sleeves: Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
4. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
5. Piping shall not pass above electrical panels, motor control centers or switchboards.
6. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - a. Near each valve.
  - b. Near each branch connection, excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
  - c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - d. At access doors and similar access points that permit view of concealed piping.
  - e. Near major equipment items and other points of origination and termination.
  - f. Space at maximum intervals of 20 feet along each run.

### 3.2 VALVE INSTALLATION:

- A. All valves shall be full line size.
- B. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate above ground valves for easy access.

### 3.3 PIPING JOINT CONSTRUCTION:

- A. Pipe shall be cut square. Ream ends of pipes and tubes and remove burrs.
- B. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing.
- C. Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Brazing shall be performed by a Certified Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

### 3.4 HANGER AND SUPPORT INSTALLATION:

- A. Install seismic restraints on piping in compliance with CBC Chapter 16A.

- B. Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.
- C. All piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield.
- D. Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
- E. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.
- F. Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.
- G. Provide additional supports for equipment, valves or other fittings.
- H. Support pipe within 12" of all changes in direction.
- J. Install hangers for horizontal copper piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.
  - 1. 1/2" to 1-1/2": Maximum span, 5 feet; minimum rod size, 3/8".
- K. Install support for vertical copper piping every 10 feet.

### 3.5 CONNECTIONS:

- A. Connect piping to HVAC equipment.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.6 TESTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.
- B. Procedures for charging and purging of systems and for disposal of refrigerant shall be in accordance with ASHRAE 15 "Safety Standard for Refrigeration Systems", latest edition. Test refrigeration system in accordance with ASME B31.5.
- C. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70F.
- D. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge.

- E After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment.
- F. System Charging and Startup Test: Charge the system after satisfactory completion of the evacuation test. The entire system shall then be tested for leaks with electronic leak detectors. Test to no leakage.

END OF SECTION

## SECTION 233113 – AIR DISTRIBUTION

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
  - 1. Air distribution system.
  - 2. All material and equipment as shown or noted on the drawings or as specified.
  - 3. Acceptance testing as required to comply with Title 24 energy code. If a HERS rater is required to witness the test, the HERS rater shall be paid for under this specification section.
  - 4. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, ductwork, piping, braces, housekeeping pads, supports and related items no longer required.
- B. Work Specified Elsewhere:
  - 1. Section 230010 “General Mechanical Provisions”
  - 2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
  - 3. Section 230700 “HVAC Insulation”
  - 4. Section 237000 “HVAC Equipment”
  - 5. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
  - 6. Painting unless specifically called for in the drawings or specifications.
  - 7. Carpentry.
  - 8. Undercutting of doors and door louvers.

#### 1.3 QUALITY ASSURANCE:

- A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.
- B. Comply with SMACNA's “HVAC Duct Construction Standards – Metal and Flexible”, latest edition, for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with NFPA 90A “Installation of Air Conditioning and Ventilating Systems” and with NFPA 90B “Installation of Warm Air Heating and Air Conditioning Systems”, latest editions.
- D. Comply with NFPA 96 “Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations”, latest edition.

- E. Welder Qualifications: Welders shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified welder shall bear evidence of current certification thirty (30) days before commencing work on project.
- F. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

## PART 2: PRODUCTS

### 2.1 DUCTWORK MATERIALS:

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50. Minimum 26 gauge unless noted otherwise. Shall comply with CMC Chapter 6 Duct Systems.
  - 1. All duct sizes shown on the Drawings are clear inside dimensions. Allowance shall be made for internal lining, where specified, to provide the required free area.
  - 2. All ductwork shall be constructed for a minimum pressure class as listed below, unless stated otherwise, for the following systems:
    - a. Typical low pressure supply ductwork: 2” wg positive.
    - b. Typical return ductwork: 2” wg negative.
    - c. Typical low pressure exhaust ductwork: 2” wg negative.
- B. Rectangular Ductwork: Metal ductwork shall be G90 coated galvanized sheet steel of lock forming quality, ASTM A653, with gauge and construction to match SMACNA Standard for pressure required, 26 gauge minimum. Pittsburgh lock shall be used on all longitudinal seams. SMACNA Seal Class A. TDC with gasket transverse joint.
- C. Round Ductwork, Concealed: Ductwork shall be galvanized steel, spiral lockseam duct, ASTM A653, with gauge and construction to match SMACNA Standard for pressure required, 26 gauge minimum. Slip joint or pipe coupling connectors. Snap lock shall not be allowed due to sealing problems. McGill Airflow Uni-Seal.
- D. Round Metal Ductwork, Exposed to View: Spiral wound factory fabricated galvanized steel, gauges in accordance with the CMC, 26 gauge minimum. All fittings shall be factory fabricated with all seams fully continuously welded. Tees and laterals shall be conical type with continuously welded seams. Connections to plenums shall be with bell-mouth fittings. 12” and smaller ells shall be two piece die-stamped. Elbows larger than 12” shall be five piece. Shop fabricated fittings are not acceptable. Snap lock shall not be allowed due to sealing problems. McGill Airflow Uni-Seal.

- E. Flexible Ductwork, Insulated: Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 75F. One pound per cubic foot minimum density glass fiber insulation. 1-1/2" thickness, R-6 where ductwork is within the building thermal insulation envelope. 2" thickness, R-8 where ductwork is outside the building thermal insulation envelope. Seamless metalized reinforced polyester vapor barrier jacket. Continuous internal liner bonded to galvanized steel wire helix. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4,000 FPM air velocity. Duct shall comply with NFPA 90A. Casco HP-25, JP Lamborn MHP, Thermaflex M-KC.
1. Duct Joint: Sheet metal collar to which flexible duct is attached shall be 2" minimum in length. Sheet metal sleeves of 4" minimum in length shall be used to join two sections of flexible duct. Flexible duct joints shall be secured to collar or sleeve with stainless steel or nylon draw bands. DuroDyne Dyn-O-Ties.
- F. Acoustic Duct Liner: Glass fiber duct liner, comply with ASTM C1071. Installed thermal resistance at a mean temperature of 75 degrees F shall meet or exceed indicated R-value. Maximum thermal conductivity shall not exceed 0.24 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 75 degrees F. One side coated to prevent fiber erosion up to 6,000 FPM. Average noise reduction coefficient of 0.70 for 1" thickness and 0.95 for 2" thickness. 1-1/2 pound per cubic foot minimum density. 1" thickness, R-4.2 where ductwork is within the building thermal insulation envelope. 2" thickness, R-8 where ductwork is outside the building thermal insulation envelope and/or above the roof. CertainTeed ToughGard R, Johns Manville Linacoustic RC, Knauf Sonic XP, Owens Corning QuietR.
- G. Duct Liner Adhesive: Water based, shall meet ASTM C916 Type II requirements. Childers Chil-Quik CP-127, Design Polymeric DP2501, Foster 85-60, Vimasco 795.
- H. Duct Sealants:
1. Joints Exposed to Weather: UV resistant, water resistant. Sealant shall be GE SilPruf SCS2000 or SilGlaze II SCS2800, without substitution.
  2. Joints Not Exposed to Weather: Fiber reinforced. White in color. Childers Chil-Duct CP-148, Design Polymeric DP1030, Foster 32-17, Hardcast Versa-Grip 181, Hardcast CCWI-181.
  3. Spiral Wound Joints Not Exposed to Weather and Exposed to View in Finished Areas: Gray in color. Childers Chil-Flex CP-146, Design Polymeric DP1010, Foster 32-19, United Duct Sealer WB.

## 2.2 AIR TERMINALS AND DUCT FITTINGS:

- A. Grilles (Including Diffusers, Registers, and Louvers):
1. Information on Drawings: Refer to Grille Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Titus. Equivalent models of Anemostat and Krueger are acceptable. Refer to the floor plans for neck size, CFM, air diffusion pattern and fire damper, if required.
  2. Performance: Submit complete performance data (throw, pressure drop, noise level, etc.) for all grilles proposed, other than those scheduled. Testing shall be in accordance with ANSI/ASHRAE Standard 70 "Method of Testing the Performance of Air Outlets and Air Inlets", latest edition. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, pressure drop, throw and noise level.

3. Frame and Accessories: All supply, return, and exhaust grilles shall not have an opposed blade volume control damper unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawings. Key or screwdriver operated, no slide bars.
  4. Finish: All ceiling and wall grilles and all louvers shall have a paintable white finish unless otherwise noted. Interior components, everything behind the face plate, shall be painted flat black. Floor grilles shall have an anodized aluminum finish unless otherwise noted.
- B. Spin-In Fittings: Same material and gauge as ductwork with die-formed mounting groove. Sheet Metal Connectors.
- C. Branch Duct Volume Control Damper (VCD):
1. VCD in Rectangular Ducts: Opposed blade, 8" maximum blade width, 16 gauge galvanized steel blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16 gauge galvanized channel frame, actuating rod and linkage out of air stream. Ruskin MD35.
  2. VCD in Round Duct: Single blade damper, minimum 20 gauge galvanized frame and blade. Ruskin MDRS25.
  3. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, provide stand-off platform at least 1/4" higher than the insulation thickness and slit insulation to allow handle to protrude. Ventlok 641 (with 607 open end bearing for round ducts).
  4. All branch dampers that are inaccessible shall be provided with remote operators. Regulators shall extend to and through ceiling with neatly installed hardware at the finished ceiling. Young Regulator 820AC, 830ACC, or 5020CC.
    - a. Remote operator for inaccessible dampers: Cable control system with concealed ceiling regulator, cup, and polished chrome cover plate. Young Regulator 270-301.
- D. Extractor: Curved blade turns in adjustable position rigid frame. Tuttle & Bailey.
- E. Turning Vanes: Double wall, hollow metal, air foil shape with rail. Spacing in accordance with manufacturer's recommendations. Aero Dyne HEP.
- F. Flexible Connection: UL listed, fire retardant neoprene coated fiberglass cloth. Minimum density of 30 ounces per square yard, rated to 200 degrees F. Overall length of 9 inches consist of 3" metal, 3" fabric, 3" metal. Duro Dyne Metal-Fab Neoprene, Ventfabrics Metaledge Ventglas.
- G. Smoke Detectors, Duct Mount: Smoke detector shall be photoelectric type, 115 VAC. The detector shall operate at air velocities from 300 FPM to 4,000 FPM. The detector head shall not require additional filters or screens. The detector shall be mounted in a sheet metal housing with removable cover. A visual indication of alarm and pilot must be proved on detector front mounted at 30 degrees angle for a wide viewing angle. Manual test and reset switch on the front of the detector. Provide remote test and reset station at ceiling. Terminal connections shall be of the screw type. Power supervisory relay. Minimum of two sets of alarm contacts (one reserved for fire alarm system). UL listed. California State Fire Marshal listing #3240-1004:0108. Air Products and Controls, Ltd. SM-501 or SL-2000 series.

H. Duct Access Door:

1. Rectangular: Insulated double wall door. Full piano hinge. Cam latch. Pressure rating to match application. Air Balance, Ductmate.
2. Round: Three layers of stamped steel. Inside panel shall consist of two layers of metal which are spot welded together along the rim, encapsulating high density fiberglass insulation (25/50 rated). Closed cell neoprene gasket bonded to the inside of the door. Zinc plated conical springs installed between the inner and outer door. Polypropylene molded knobs with threaded metal inserts. Knobs shall be easily turned by hand and shall be UL94HB listed. Zinc plated carriage bolts, clinched and sealed to the inner door. Provide self adhesive template for the exact size of duct opening. Pressure rating to match application. Ductmate.

- I. Bird Screen: Screen shall be 1/2" 16 gauge galvanized steel mesh, unless otherwise noted.

2.3 HANGER AND SUPPORT:

- A. Hanger Strap: Galvanized sheet metal strap, 1-1/2" wide x 18 gauge minimum.
- B. Hanger Rod: All threaded rod with galvanized finish, 3/8" diameter minimum. Anvil, B-Line, Tolco, Unistrut.
- C. Construction Channel: 12 gauge, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.
- D. Flexible Duct Supports: Galvanized sheet metal straps, 4" wide with 6" wide fiberglass pad between duct and hanging strap.

PART 3: EXECUTION

3.1 DUCTWORK INSTALLATION:

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA Standards. Ductwork shall be built to a pressure classification equal to or greater than the maximum operating pressure at that point in the ductwork. Duct and fittings shall be sealed to SMACNA Seal Class A. A copy of these standards shall be maintained at the job site at all times. Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Access: Provide duct access doors as required to adjust equipment and dampers. Provide wall or ceiling access panels, or remote actuators as required where equipment and dampers are not otherwise accessible. Ventlok 666 concealed remote actuator with zinc finish on cover.
3. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.
4. Flexible Connections: Connection of ductwork to any vibrating equipment shall be with 3" minimum flexible connection. Install with ample slack and uniform gap. There shall be no metal to metal contact across flexible connection. Flexible connections exposed to weather shall have a protective sheet metal cover. Connectors shall be attached in such a manner to provide an airtight and waterproof seal.

5. Ducted Returns: All air handling equipment that is not directly located in the space that it serves shall have ducted returns.
6. Acoustic Lining: Unless otherwise indicated, all supply and return ductwork in equipment rooms including outside air intakes, all ductwork exposed to weather and other ducts as indicated on drawings, shall have acoustic lining. Where acoustic lining is installed, increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.
7. Duct Fire Caulking: All ductwork passing through rated assemblies that do not have a fire or fire/smoke damper shall be installed with a UL listed fire caulking assembly. Exact details of UL listed assembly shall be followed. Provide Inspector of Record and project engineer submittal showing UL listed fire caulking detail that the contractor intends to use for each condition. In lieu of fire caulking, at contractor's option, provide fire damper installed in accordance with UL listing.

B. Low Velocity-Low Pressure, up to 2,000 FPM and up to 2" Water Gauge:

1. Sheet Metal Ductwork:
  - a. Elbows: Elbows shall be standard radius type with centerline radius to duct diameter of 1.0 (R/D ratio). Elbows with less than standard radius and square elbows shall be fitted with turning vanes.
  - b. Tees: Tees in supply ductwork shall be straight tap-in with extractor or 45 degree take-off. Grilles or branches in supply ductwork shall be a minimum of eight duct diameters downstream of tees.
  - c. Duct Joints and Seams: All joints and seams which are not exposed to weather shall be sealed airtight with duct sealant. All joints and seams exposed to weather shall be sealed air and watertight with silicone sealant. All joints on spiral wound metal ductwork not exposed to weather shall be sealed airtight with gray duct sealant.
  - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
2. Spiral Wound Metal Ductwork, Exposed to View: At side duct grilles, the grille shall be cut directly into the spiral duct. Duct to duct joints shall be made with the spiral seam rotated so that the seam forms a continuous helical pattern across the joint.
3. Flexible Ductwork, Insulated: The use of insulated flexible duct is limited to the last 5 feet of each branch duct. Example: one 5 foot section of flexible duct may be used to connect the grille to the sheet metal branch duct. No joints are permitted in this 5 foot length. Hangers shall be 4" wide metal straps spaced to prevent sagging, 42" maximum spacing. Insert 6" wide fiberglass pad between duct and hanging strap. Duct joints shall be secured to collar or sleeve with stainless steel or nylon draw bands. Ducts shall be sealed using approved mastics and/or tapes. Minimum turn radius shall be in accordance with SMACNA Standards: turn radius of duct centerline not less than 1.5 times the duct diameter.

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA Standards. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.
- B. All grilles, diffusers, and registers shall be adjusted for required air patterns and to minimize drafts. Sidewall grilles shall be adjusted for 5 degrees upward deflection, unless noted otherwise.

- C. Paint interior of metal ducts that are visible through grilles and registers and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized steel primer.
- D. Smoke Detector, Duct Mount: Detector shall be installed in accordance with manufacturer's recommendations. Provide duct access doors and ceiling access panels as required, label per CBC. Manufacturer's instructions shall be available to the inspecting authorities. Detector shall be tested according to State Fire Marshal requirements.
- E. Duct Access Door: Install access doors with permanent label identifying the concealed components. Provide duct access doors at the following locations:
  - 1. Balancing dampers and backdraft dampers.
  - 2. Fire dampers, smoke dampers, and combination fire/smoke dampers.
  - 3. Duct mounted smoke detectors.

### 3.3 HANGER AND SUPPORT INSTALLATION:

- A. Install seismic restraints on ductwork in compliance with CBC Chapter 16A.
- B. Support individual ducts with hanger strap or rod. Provide hangers, supports, clamps, and necessary attachments as required to properly support ductwork from the building structure. Hangers shall be placed to support ductwork without strain on joints or fittings.
- C. Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
- D. Hangers exposed to view shall be all threaded rod and angle or channel supports.
- E. Vertical ductwork shall be supported with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets at base and at each floor, maximum 10 feet on center.
- F. Support duct within 12" of all changes in direction.
- G. Install supports for low pressure horizontal rectangular duct with the following maximum spacing. Maximum spacing is based on straight lengths of duct only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.
  - 1. 12" and Smaller in Largest Dimension: Maximum span, 8 feet.
  - 2. 13" to 48" in Largest Dimension: Maximum span, 5 feet.
- H. Install supports for low pressure horizontal round duct with the following maximum spacing. Maximum spacing is based on straight lengths of duct only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.
  - 1. 18" and Smaller: Maximum span, 8 feet.
  - 2. 19" to 48": Maximum span, 5 feet.

### 3.4 CONNECTIONS:

- A. Connect ductwork to HVAC equipment with flexible duct connectors.

### 3.5 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.
- B. Acceptance of duct systems shall be contingent upon conformance with the requirements specified in Section 230593 "Testing, Adjusting and Balancing for HVAC".
- C. Fire and Fire/Smoke Damper Certification: Contractor shall include in the Operation and Maintenance Instructions, a letter certifying that all fire and fire/smoke dampers have been tested and are fully operational.
- D. Smoke Detector Certification: Contractor shall include in the Operation and Maintenance Instructions, a letter certifying that all duct mount smoke detectors have been tested and are fully operational.

END OF SECTION

## SECTION 237000 – HVAC EQUIPMENT

### PART 1: GENERAL

#### 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

#### 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. Provide and install all required connections to existing systems as required by the plans and specifications. Integrate existing systems with all new work to provide a complete working system. The work includes, but is not necessarily limited to, the following:

1. All material and equipment as shown or noted on the drawings or as specified.
2. Temperature control system. Provide Pelican Wireless system to match existing Bakersfield City School District HVAC control system. The HVAC control system strategies and graphics shall be consistent with existing format. The control system includes control panels, control devices, line and low voltage control and interlock wiring, conduit and related equipment as required for proper operation of all controlled systems. Control and interlock wiring includes wiring to controllers, switches, timers, relays, etc. Power wiring and disconnect switches are included in the Electrical Specifications except that power wiring required for control devices such as thermostats, valves, etc., is included in the control system.
3. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, supports and related items no longer required.
4. Assist the Testing, Adjusting, and Balancing (TAB) Contractor by execute starting of equipment and operate equipment for the duration of TAB work. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by TAB Contractor, at no additional cost to Owner.

- B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
3. Section 232300 “Refrigerant Piping System”
4. Section 233113 “Air Distribution”
5. Division 22 for connection of condensate drains to equipment.
6. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in Division 26 Electrical, unless otherwise noted.
7. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
8. Painting unless specifically called for in the drawings or specifications.
9. Undercutting of doors and door louvers.

### 1.3 QUALITY ASSURANCE:

- A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.
- B. Motors shall comply with NEMA MG-1.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- D. Fans shall have AMCA certified performance ratings and shall bear the AMCA Certified ratings seal.
- E. Power ventilators shall comply with UL 705.
- F. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.
- G. Warranty: Temperature Controls Contractor shall provide a one year parts and labor warranty on the entire HVAC control system.

### 1.4 COORDINATION:

- A. Coordinate sizes and locations of structural steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## PART 2: PRODUCTS

### 2.1 EQUIPMENT:

- A. General Requirements:
  - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities and efficiencies are to be considered minimum.
  - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment, different than scheduled units, showing actual job conditions, required clearances for proper operation, maintenance, etc.
  - 3. Ratings:
    - a. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
5. Electrical:
  - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
  - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
  - c. Motors: Continuous duty at ambient temperature of 104 degrees F, at altitude of 3300 feet, and for temperature rise in accordance with ANSI/NEMA MG-1 limits for insulation class, service factor, and motor enclosure type. Motor shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof (ODP), NEMA Design B on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be totally enclosed fan cooled (TEFC). Motors in a fan air stream shall be TEFC or totally enclosed air over (TEAO). Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
  - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
  - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
  - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
6. Fan Selection:
  - a. Fan Curves: Performance curves shall be submitted for all units of 3,000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency toward increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.

- b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure (TSP) includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.30 inches of water column, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2, UL 900, and SFM 12-71-1, Part 12, Title 24, CCR. Furnish and install one complete change of all filters after air balance is completed and prior to acceptance. Provide pressure differential gage across all filter banks.
  - b. Filter Media: 2" media. Pleated panel filter, MERV of 13 or better when tested in accordance with ASHRAE Standard 52.2. Initial clean filter resistance 0.30 inches of water gage maximum at 500 FPM face velocity. Throw-away frame. UL 900 listed. AAF Flanders PREpleat M13, Columbus Industries, Koch Multi-Pleat Green13.
8. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16 gage, galvanized wire mesh screen.
9. Mixing Dampers: Opposed blade, 6" maximum blade width, 16 gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16 gage channel frame, 1% maximum leakage at 4 inches of water column in accordance with AMCA 500 for outside air dampers, actuating rod out of air stream. Arrow.
10. Sound Ratings: Shall be in accordance with ASHRAE 36 - 72. Sound ratings shall not exceed scheduled values.
11. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
12. Coils:
- a. Construction: Copper tube. Copper or aluminum 0.0075" minimum thickness fins hydraulically or mechanically bonded to tube. 16 gage galvanized steel rigid channel coil casing. Rated 750 psig minimum working pressure. All coils shall have connections at same end. Wherever two or more coils are being controlled by a single valve, each coil shall be installed with a separate balancing cock and a Pete's Plug at each outlet.
  - b. Capacity: Ratings certified by AHRI in accordance with AHRI Standard 410. Cooling coil face velocity shall not exceed manufacturer's published ratings or 600 FPM. Include coil selection calculations in shop drawings.
  - c. Direct Expansion (DX) Coils: Copper suction header silver brazed to tubes, distributing tubes and expansion valve. Working pressure 400 psig minimum. 10 fins per inch maximum.

B. Air Conditioning Unit, Heat Pump:

1. General: Self-contained heat pump unit designed for outdoor installation. Factory assembled and tested. Refer to Paragraph 2.1,A for General Requirements. Provide all starters and relays required for operation. 24-volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Outside air inlet. Drain pan. Vane axial supply fan with direct drive electrically commutated variable speed motor. Integrated defrost system to prevent excessive frost accumulation during heating duty. AHRI certified. Carrier 50GCQ, Trane.
2. Refrigeration: Fully hermetic, heat pump duty 2-stage scroll compressor with internal vibration isolating mount. High pressure switch, low pressure switch, expansion valve, filter drier, suction line accumulator. Service gage connections on suction and discharge lines. Air-cooled condenser with totally enclosed motor and direct drive propeller fan. Non-ferrous finned coil. Low ambient cooling operation down to 35 degree F. 5 year extended warranty on compressor(s).
3. Outside Air Damper and Hood: Damper shall be modulating type. Provide rain hood with filter.
4. Economizer and Fault Detection and Diagnostics (FDD) System: Air-side, dry-bulb, integrated economizer and Energy Commission certified FDD system in compliance with Title 24 Energy Code. Provide with barometric relief. Dampers shall be modulating type where the unit will exhaust at the minimum outside air setpoint and exhaust 100% during economizer mode. Provide sensors, direct drive actuators, and PEARL economizer logic module controller to monitor system operation including system status, detect failures/faults and annunciate locally on thermostat. The economizer controller shall include control strategy for demand control ventilation (DCV) and accept input from carbon dioxide (CO<sub>2</sub>) sensor. The PEARL economizer controller shall communicate with Pelican Wireless System. Provide rain hood with filter. 5 year warranty on economizer assembly. MicroMetl, Pelican PEARL.
5. Accessories: Time guard control circuit, condenser coil guard, hinged access panels, condensate overflow switch, fan/filter status indicator, filter maintenance indicator air, phase monitor protection, electric resistance heater, Pelican Wireless thermostat with integral carbon dioxide (CO<sub>2</sub>) sensor, smoke detector, roof curb to match roof slope, UL listed NPBI type ion generator, controller interface for communication to Pelican Wireless thermostat.

C. Split System, Heat Pump:

1. General: Refer to Paragraph 2.1,A for General Requirements. Completely assembled and factory tested. Provide all starters and relays required for operation. All components by same manufacturer. Carrier, Mitsubishi Electric.
2. Outdoor Unit:
  - a. Compressor: Variable speed inverter driven hermetic rotary compressor with vibration isolator mountings. Expansion valve, accumulator, recycling timer to prevent compressor short cycling. High temperature protection. Motor overload protection. Crankcase heater, base pan heater. Low ambient cooling operation down to 22 degree F. High and low side service valves. Single phase start assist kit. 7 year extended warranty.
  - b. Fan and Coil: Finned tube non-ferrous coil (condenser coil with copper tubing and aluminum fins). Air-cooled unit with totally enclosed motor and direct drive propeller fan. Non-ferrous finned coil. Motor overload protected, permanently lubricated ball bearings, resiliently mounted.

c. Cabinet: Weatherproof constructed from galvanized steel plate, factory paint.

3. Indoor Unit:

- a. Supply Fan: Direct drive, multi-speed centrifugal fan. Motor overload protected, permanently lubricated ball bearings.
- b. Indoor Coil: Copper tube, aluminum fin, DX coil.
- c. Condensate Pan: Install under complete coil area with factory installed condensate lift pump and drain connection.
- d. Filter: Factory supplied washable media.
- e. Ceiling Cassette Cabinet: Cabinet is constructed of zinc-coated steel, factory paint. Fully insulated discharge and inlet grilles. Filter access thru ceiling panel/grille. Mounting brackets. Factory knock-out provision for outside air intake connection.

4. Controls: Microprocessor control system with integral temperature sensing, temperature selection, room temperature indication, self-diagnostics. Automatic cooling/heating changeover, power failure automatic restart safety. Provide controller interface for communication to Pelican Wireless thermostat.

2.2 EQUIPMENT SUPPORT:

- A. Roof Curbs: Double wall insulated galvanized steel curb with mounting flange, mitered and welded corners, 1-1/2" thick rigid fiberglass insulation adhered to inside walls, galvanized metal liner, 1-1/2" wood nailer, curb height shall provide 8" minimum clearance between finish roof and bottom of HVAC equipment and accessories, pitched to match roof slope. Size as required to suit roof opening and equipment base.

2.3 EQUIPMENT IDENTIFICATION:

- A. Equipment Labels: Plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). 2" high lettering minimum, white on black background. Contact type permanent adhesive, compatible with label and with substrate. All equipment shall be labeled. Seton.

2.4 TEMPERATURE CONTROL SYSTEM:

- A. Scope: Provide all labor, materials and services necessary for a complete installation and operable system utilizing wireless communication with cloud based servers. The wireless, HVAC control system includes gateways, repeaters, control panels, control devices, line and low voltage control and interlock wiring, conduit and related equipment as required for proper operation of all controlled systems. Control and interlock wiring includes wiring to controllers, switches, timers, relays, etc. Power wiring and disconnect switches are included in the Electrical Specifications except that power wiring required for control devices such as thermostats, valves, etc., is included in the control system. The Controls Contractor shall have the responsibility as the expert in the proper application of his control components and system. The final design, installation, and operation of the control system are the responsibilities of this Contractor. The Controls Contractor is responsible to assure that all field control devices are compatible with HVAC control system hardware and software. The Controls Contractor shall make additions and/or modifications to the design as required at no additional cost.

- B. Type of system: The control system shall be wireless electric/electronic, Pelican Wireless Systems, to match existing. The HVAC control system shall include a network of internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a wireless gateway. The wireless gateway shall connect to the District's wide area network over a TCP/IP connection. Access and control of the HVAC control system is through a web based management tool which sits on a cloud server and shall be accessible either locally or remotely via the Internet.
- C. HVAC Equipment Interface: It shall be the responsibility of the Controls Contractor to obtain factory wiring diagrams of all HVAC equipment provided on this project to insure proper controls interface without jeopardizing factory internal safeties of the equipment.
- D. System Components:
1. Wireless Gateway (WG), GW400: Provide wireless gateway(s) to facilitate the communication link between the entire system and a cloud based server. Communication with Cloud servers shall be secured using Advanced Encryption Standard (AES). WG shall be able to communicate with up to 2000 devices and have the following features as a minimum:
    - a. One Ethernet port
    - b. CAT5 Ethernet cable, 10 feet minimum.
    - c. One micro-USB 5VDC power input
    - d. 115VAC power adapter
    - e. 2.4 GHz IEEE 802.15.4 built-in communication processor
  2. Wireless Repeater, GR400: Provides extended wireless range to bridge long distances and/or in areas where wireless is weak. 115VAC power adapter.
  3. Internet Programmable Thermostat (IPT), TC3: IPT shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.
    - a. The IPT shall provide a touchscreen LCD display and function selectors for setting temperature setpoints, system mode (Heat, Cool, Auto, Off), fan mode (Auto, On), and light button. Thermostat shall have an integrated carbon dioxide (CO2) sensor.
    - b. The IPT shall be configurable using a web based app (WBA). No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump - B, shall be done at the thermostat. The web based user customizable configuration setting options shall include: naming the thermostat and grouping multiple thermostats; conventional or heat pump system setting; up to 6 compressor pump system setting; up to 2 stages for heating and 2 stages for cooling; up to 2 stages for fan; temperature display in Fahrenheit or Celsius; temperature range setting limitation for heating and cooling; ability to disable and enable keypad lockout control; display energy consumption units in kilowatt, btu, ton or watt; notification sensitivity settings of High, Medium, and Low; enable fault alarm when temperature exceed user defined safe range.
    - c. IPT settings and control through the web base app shall be in real-time and include space temperature, system mode (Heat, Cool, Auto, Off), fan mode (Auto, On), current setpoint, relay status (Heat/Cool and Fan), historical trend graphs, scheduling, lock and unlock entire thermostat's keypad, and lock and unlock the thermostat's fan mode setting.

4. Input Temperature Sensor (ITS), TA1:
  - a. The ITS shall connect to the IPT over 3-wires, provide at least one external 10K Type II thermistor temperature sensor input, and shall be accurate to +/- 1°F. ITS shall be able to be installed up to 500 feet away from IPT using standard thermostat wiring.
  - b. WBA shall be able to record and provide at least two years of past temperature data for ITS. The trend data shall be viewable on the WBA.
  
5. Internet Enable Economizer (IEE) Controller, PEARL: The IEE shall connect to the ITS with only 3-wires. No additional wiring shall be required between the IEE and the ITS to gain complete Title 24 compliant economization control and demand control ventilation. IEE shall be able to send California Title 24 fault and diagnostics codes to the WBA, email addresses, and/or text messages. IEE shall be able to be installed up to 500 feet away from IPT using standard thermostat wiring.
  - a. IEE shall provide three 10K Type II external thermistor temperature sensor inputs for supply air, return air, and outside air.
  - b. WBA shall be able to record and provide at least two years of past data for IEE. The trend data shall be viewable on the WBA. Data shall represent historical representations of supply and outside air temperatures, outside air damper position, and calls for economization.
  - c. IEE shall have a 0-10VDC input for outside air damper position feedback and shall have a settable 0-10VDC output for outside air damper actuator control.
  - d. IEE shall have a settable 0-10VDC output for variable frequency drive (VFD) control. IEE shall be configurable for different VFD speeds based on calls for cool, heat, and ventilation.
  
9. Relays: 24 VAC single pole, single throw (SPST).
10. Electric Actuators:
  - a. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield where exposed to weather. 24 volt. Belimo.
  - b. Damper Actuators: Positive position feed back and spring return. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.
  
11. Wall Switches: Plates for all wall switches and timers shall match those specified in Electrical Specification Sections.
12. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
13. Temperature Control Panels: Hinged, lockable front panel. Each panel and each control device or readout on the front of the panel shall be identified with an engraved plastic label with 1/4" high lettering, white on black background. Pilot lights shall be the push-to-test type.

E. Web Based Graphical User Interface:

1. The web based app (WBA) shall be able to run on any personal computer that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers' functionality. The WBA platform shall be able to run on any internet accessible smartphone and/or tablet that have a web browser compatible with HTML5.
2. The WBA shall allow up to a minimum of 100 simultaneous users to access the system.
3. The web based client shall support at a minimum, the following functions:
  - a. User log-on identification and password shall be required. Users shall have administrator and user definable access privileges.
  - b. HTML programming shall not be required to display any graphics or data on the web page.
  - c. Storage of data shall reside within the cloud server and shall not sit within the client's computer or device. The controls system that requires data storage on a client computer or an on-site server is not acceptable.
  - d. Open application programming interface (API) with XML data output.
4. Schedules: The WBA shall provide user with access to setting IPT schedules. Up to 12 schedule periods per day shall be available for each IPT. Schedules shall be available as weekly (7-day), daily, or weekday/weekend (5-2). The WBA shall provide the user the ability to view schedules, add/modify schedules, assign thermostat to a group schedule, and be able to delete schedules.
5. Trending:
  - a. The WBA shall provide real-time trend information on each IEE's call for economization and on each IPT's space temperature, temperature setpoints, and current call (Heat, Cool, and/or Fan).
  - b. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall be viewable on the WBA. Trend data shall include space temperature with resolution of every 1/10th of a degree Fahrenheit, IPT's temperature setpoints, and indicate whether the thermostat was calling for Heat, Cool, and/or Fan.
6. Alarm Notifications:
  - a. The WBA shall provide automatic alarming functionally based on real-time monitoring of space temperature and temperature change, IPT's temperature setpoints, and IPT's current call (Heat, Cool, and/or Fan).
  - b. The WBA shall be able to provide user with the ability to view alarms, delete alarms, and set alarm notification sensitivity level to High, Medium, or Low.
  - c. Alarms shall be able to be sent via email and/or text message to up to 100 or more users.
7. Consumption Usage:
  - a. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.

- b. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kilowatt and/or therm.
- c. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the controls system.
- d. The WBA shall be able to record and display up to at least two years of consumption usage information.

## 2.5 EXTRA MATERIALS:

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Filters, Temporary: Provide temporary filters for all fans that are operated during construction. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure. After all construction dirt has been removed from the building, install new filters at no additional cost to Owner.
  - 1. Filters used for temporary operation shall be the same as permanent filters for the application.
  - 2. Filters used for duct openings may be 1” thick pleated media, disposable type.
- C. Filters, Extra:
  - 1. Furnish and install one set of filters in each air handling system prior to TAB work.
  - 2. Furnish and install one complete change of all filters for each unit after air balance is completed and prior to acceptance.
  - 3. Furnish one spare set of filters for each air unit to Owner prior to acceptance.

## PART 3: EXECUTION

### 3.1 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block or otherwise hinder the equipment. All equipment shall be securely anchored in place. All equipment shall be installed level. Maintain manufacturer’s recommended clearances for service and maintenance.
  - 1. Roof Mounted Units: Secure roof mounted equipment to roof curbs with cadmium-plated hardware.
  - 2. Ceiling Units: Suspend units from structure; use hanger rods, steel wire, or metal straps.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.
- C. Equipment Platforms: Shall be as shown on drawings and as follows: Flashing and platform cover shall be minimum 22 gage sheet metal. All joints and seams shall be soldered with minimum 2” overlaps. Extend drip lip down minimum 3”. Provide 30 lb felt under platform cover.

D. Equipment Identification: All equipment shall be identified with permanent label.

### 3.2 TEMPERATURE CONTROL SYSTEM INSTALLATION:

A. General: The internet enabled wireless thermostat shall start/stop all equipment. Controls Contractor shall coordinate HVAC control system program schedule with Owner.

B. Examination:

1. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
2. Notify the owner's representative in writing of conditions detrimental to the proper and timely completion of the work.
3. Do not begin work until all unsatisfactory conditions are resolved.

C. Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation.
3. All control wiring and conduit for temperature control system that is not shown or described on the electrical drawings will be installed by Temperature Control Contractor under this Section. All control wiring will be installed in EMT conduit in dry locations and EMT with weather-tight fittings or rigid IMC conduit with seal tight connections in exposed locations. Control wiring installed above accessible ceilings will be allowed in plenum rated cable is installed in a neat and professional manner.

D. Location and Installation Components:

1. Locate and install components for easy accessibility; in general, space sensors are to be mounted 48 inches above finished floor with a minimum of 3'-0" clear access space in front of sensors. Obtain approval on locations from owner's representative prior to installation.
2. All instruments, switches, transmitters, etc. shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.
3. Identify all equipment and panels.
4. Mount all space sensors/thermostats with buttons or levers at 48 inches above finished floor in accordance with ADA requirements.

E. Interlocking and Control Wiring:

1. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state, and local electrical codes. All 120VAC interlock wiring will be in conduit.
2. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with owner's representative prior to rough-in.
3. Provide auxiliary pilot duty relays on motor starters as required for control function.

4. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings, coordinated with Electrical Contractor.
5. All control wiring in the mechanical, electrical, telephone rooms to be installed in EMT conduit. All other wiring to be installed neatly and inconspicuously per local code requirements.

F. Sequence of Operations:

1. General: Connect the new campus to the existing District's web based, wireless HVAC control system.
2. System Operation Schedule: Coordinate with Owner.
3. Heating/Cooling Units: Heating setpoint 70°F and cooling setpoint 75°F. The unit shall run per the system operation schedule through the HVAC control system. Room thermostat shall be wall mounted. The unit setpoint shall be adjustable +/- 2°F from a switch located on the thermostat. The HVAC control system shall control the heating/cooling unit to maintain setpoints. The system shall monitor the unit status with a current sensor and the supply air temperature. The unit shall be capable of integrated economizer operation and demand control ventilation. Economizer fault alert shall be displayed on the thermostat. Unit as scheduled on drawings shall have a smoke detector in the unit or main supply duct which shall shutoff the unit on alarm and signal the fire alarm system. System fan shall run during occupied hours to provide minimum outside air. Coordinate with Div 26 and 28.
  - a. Outside Air Reset: The integrated CO2 sensor on thermostat shall control the air handler system outside air damper when the system is in the Heating or Cooling modes. The CO2 sensor setpoints and the outside air damper setpoints shall be developed in coordination with the Balance Contractor.
    - (1) CO2 Sensor Setpoint: The Control Contractor shall determine the base ambient CO2 concentration level after the air handler system has been balanced and the building is unoccupied. The lower and upper CO2 concentration setpoints shall be developed as follows:
      - Aa. The lower CO2 concentration setpoint shall be 200 ppm, adjustable, above the base ambient CO2 concentration level.
      - Bb. The upper CO2 concentration setpoint shall be 600 ppm, adjustable, above the base ambient CO2 concentration level.
    - (2) Outside Air Damper Setpoints: The Control Contractor shall set the outside air damper minimum position setpoints as follows:
      - Aa. The lower outside air damper position setpoint shall be 50 CFM, outside airflow at this condition.
      - Bb. The upper outside air damper position setpoint shall be 450 CFM, outside airflow at this condition.

- (3) Outside Air Damper Control: The unit controller shall monitor the CO2 concentration every 5 minutes while the unit is "On". On system startup, the outside air damper shall open to the lower damper position setpoint. If the CO2 concentration is above the upper CO2 setpoint, the damper shall open by 20% of the range between the lower and upper damper positions. The damper shall not open more than the upper position setpoint if the unit is not in the "Ventilation" mode. If the CO2 concentration is below the lower CO2 setpoint, the damper shall close by 20% of the range between the lower and upper damper positions. The damper shall not close more than the lower position setpoint.
4. IDU/ODU: Heating setpoint 70°F and cooling setpoint 75°F. The unit shall run per the system operation schedule through the HVAC control system. Room thermostat shall be wall mounted. The unit setpoint shall be adjustable +/- 2°F from a switch located on the thermostat. The HVAC control system shall control the heating/cooling unit to maintain setpoints. Controls Contractor shall provide the interlock wiring between the controller and the indoor unit, and the interlock wiring between the indoor and outdoor unit. The HVAC control system shall monitor system status with current sensors (one each for IDU and ODU).
5. Fan Shut Off, Smoke Detectors: On signal from the fire alarm (refer to Div 26), all units as scheduled on plans, in the area signaling an alarm shall shut down. Coordinate with Div 26 for interface locations.

G. Installation, Programming, Training, Testing and Acceptance, O&M's:

1. General: All electrical work shall be in accordance with the California Electrical Code and this Section. All electric/electronic systems shall be hardwired in conduit or using plenum rated cable as previously noted. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; the Construction Manager shall approve location. No structural member shall be weakened by cutting, notching, boring, or otherwise modified. Provide a 120 volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit. Penetrations of fire rated walls, floors, or ceilings shall be firestopped.
2. Labeling of System: Controls Contractor shall provide complete labeling of all terminals at all panels or equipment terminal strips and wiring. Equal to Brady marking on wires and number on terminals in sequence corresponding to control diagram.
3. Programming: The web based HVAC control system operational program shall be provided by manufacturer. The Controls Contractor shall be responsible for programming the system and shall coordinate the scheduling, on/off times, with the Owner. Prior to commissioning, the Controls Contractor shall provide any testing program he feels necessary to fully test the operation of the various components. The Controls Contractor shall provide to the Owner programming functions that will allow for future addition and deletion of operating HVAC systems and zones by the Owner.

4. Training: Prior to final acceptance, the Controls Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete demonstration of the system. Dates and times of the training sessions shall be coordinated through the Architect not less than one week prior to session. A total of 8 hours of instruction shall be provided. The Controls Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The Controls Contractor shall submit a copy of this log on request.
5. Testing and Acceptance: The Controls Contractor shall furnish a complete and operating system. The Controls Contractor shall also verify, in the presence of the Architect/Engineer, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by Owner:
  - a. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
  - b. All inputs shall be displayed and all event-initiated functions shall be demonstrated.
  - c. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
  - d. Deliver all Record Drawings, wiring diagrams, equipment specifications, Installation and Operation Manuals and other documentation as required to describe the system.
  - e. Complete operator training in the use, programming, and operation of the system.
6. Verification: A written testing and commissioning report must be submitted for approval before acceptance. In addition to the Controls Contractor's testing and commissioning report, the Owner may independently verify the test results. The report on test results shall include setpoints and operating ranges of all components.
7. Operation and Maintenance Manuals: Furnish Operating and Maintenance Manuals for all components. These manuals shall contain full documentation which shall include, without being limited to, the following:
  - a. General description and specifications.
  - b. Installation and initial checkout procedures.
  - c. Principles and theory of operation.
  - d. Complete trouble-shooting procedures and diagrams.
  - e. Complete alignment and calibration procedures for all components.
  - f. Preventative maintenance requirements.
  - g. Detailed schematics and assembly drawings.
  - h. Complete recommended spare parts list including unit prices.
10. Fan Shut Off, Smoke Detectors: On signal from the fire alarm (refer to Div 26), all units as scheduled on plans, in the area signaling an alarm shall shut down. Coordinate with Div 26 for interface locations.
11. Domestic Hot Water Circulating Pumps: Pump shall run per building occupancy schedule, via timeclock.

- B. Installation: All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. All electric/electronic systems shall be hardwired in conduit. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise. Provide a 120 volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit. Set, test and adjust the system for proper operation.

### 3.3 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

### 3.4 INDOOR ENVIRONMENTAL QUALITY AND BUILDING FLUSH OUT:

- A. General: The requirements of ASHRAE Standard 62-1, Section 7 shall apply during construction and system startup. This includes protection of materials, air balancing, and testing of drain pans. If HVAC systems are operated during construction, they shall have filters in place. These filters shall be replaced by contractor prior to building occupancy. Contractor shall maintain a copy of this Standard onsite during construction. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.
- B. Temporary Construction Ventilation: Continuously ventilate during installation of materials that emit volatile organic compounds (VOC) and after installation until emissions dissipate. Ventilate areas directly to outside areas; do not ventilate to other enclosed spaces. Replace all filtration media immediately prior to occupancy except for unspent filters used to filter outside air. If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.
- C. Duct Protection: Turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration during dust producing activities. These activities include but not limited to drywall installation and finishing. Provide temporary ventilation as required.
- D. Duct Cleaning: On-site, inspect ducts to confirm that no oil film is present. Remove any oil. If ducts contain dust and dirt, clean them immediately, prior to substantial completion and prior to using the ducts to circulate air. HVAC system components or ductwork may only be cleaned, coated, or have applied to its surface, disinfectants, pesticides, or biocides that are registered and labeled for use in HVAC systems by state and federal EPA.

- E. Building Flush Out: Flush out the building with 100% outside air to help remove indoor pollutants prior to occupancy. After construction ends, and with all interior finishes installed, flush out the building by supplying continuous ventilation with all air handling units at their maximum outdoor air rate for at least 14 days. During the flush out, maintain a relative humidity no higher than 60%. Every attempt shall be made to maintain an internal temperature between 60°F and 78°F, but it is understood that this may not be feasible during seasonal temperature extremes. Occupancy may start after 7 days, provided flush out continues for the full 14 days and the above temperatures can be maintained. Do not “bake out” the building by increasing the temperature of the space. If continuous ventilation is not possible, flush out must total the equivalent of 14 days of maximum outdoor air. Coordinate scheduling with General Contractor to ensure time for flush out is included in project timeline.
  
- F. Post Occupancy Ventilation: When the contractor is required to perform touch-up work involving products with chemical emissions, provide temporary construction ventilation during installation and extend the building flush out by a minimum of 4 days after touch up installation, with 100% tempered outside air for 24 hours each day.

END OF SECTION

## SECTION 260573 - SHORT CIRCUIT & PROTECTIVE DEVICES COORDINATION STUDY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 0 and 1 and Sections 266000 and 267000 Specifications apply to work of this section.

#### 1.2 DESCRIPTION

- A. Provide a short-circuit and protective device coordination study for the electrical distribution system. The intent of these studies are to verify that the specified and supplied equipment are properly rated, correctly applied, and within industry and manufacturer's tolerances.
- B. The short circuit study shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the distribution system down to the smallest protective device. The short circuit study shall consider operation during normal conditions, alternate operations, emergency power conditions, and any other operations which could result in maximum fault conditions.
- C. The coordination study will determine the correct settings for the protective devices which will minimize the damage caused by an electrical fault and allow for selective coordination between the devices. The coordination study shall include the closest upstream utility protective device down to the panelboard main, branch, or feeder circuit breakers. The coordination study shall consider operation during normal conditions, alternate operation, and during emergency power conditions.

#### 1.3 DATA COLLECTION FOR THE STUDIES

- A. The contractor shall provide the required data for preparation of the study. This includes obtaining all required short circuit, X/R and impedance data from the serving utility company. The Engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after the award of the contract.
- B. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

#### 1.4 QUALIFICATIONS

- A. The Contractor shall have the coordination study prepared by qualified consultant. The consultant shall be a Registered Professional Electrical Engineer (licensed in California) who has at least ten (10) years of experience in performing power system studies.
- B. The short circuit and coordination study shall be performed using the EasyPower or ETAP for Windows computer software package.

## 1.5 SUBMITTALS

- A. The contractor shall submit the system studies within 30 days after the electrical equipment submittals have been received for review by the engineer. The electrical submittals will be reviewed but will not be approved until the power system studies have been received and reviewed.
- B. Submit six (6) bond copies of the power system studies.

## PART 2 - EXECUTION

### 2.1 IMPEDANCE ONE LINE DIAGRAM

- A. Create an impedance One Line Diagram. All electrical equipment and wiring to be protected by the overcurrent devices installed under this project and each location where the fault current will be calculated shall be shown. Clearly show, on the One Line Diagram, the schematic wiring of the electrical distribution system.
- B. Show reference nodes on the One Line Diagram referring to a formal report which shall include the following specific information:
  - 1. X/R ratios, utility contribution, and short circuit values (asymmetrical and symmetrical) at the bus of the main service, and all downstream equipment containing overcurrent devices.
  - 2. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
  - 3. Voltage at each bus.
  - 4. Identifications of each bus.
  - 5. Conduit material, feeder sizes, and length.

### 2.2 SHORT CIRCUIT STUDY

- A. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
- B. The study shall be in accordance with applicable ANSI and IEEE Standards.
- C. Determine the available 3 phase short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
- D. Present the data determined by the short circuit study in a table format which shall include:
  - 1. Node & Device identification.
  - 2. Operating voltage.
  - 3. Type of Protective device. (i.e. fuse, molded case circuit breaker...)
  - 4. Device short circuit rating.
  - 5. Calculated maximum short circuit current, 3 phase or ground fault, asymmetrical and symmetrical, and X/R ratio.
  - 6. De-rate the devices where the tested X/R ratio is less than the calculated X/R ratio. (maximum fault current multiplied by MF.)
  - 7. Comments section indicating any equipment found to be underrated.

## 2.3 PROTECTIVE DEVICE COORDINATION STUDY

- A. All requirements of the current California Electrical Code shall be adhered to.
- B. The coordination study shall include the closest upstream utility protective device down to the panelboard main, branch, or feeder circuit breakers. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination.
- C. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.
- D. Graphically illustrate on log-log paper that adequate time separation exists between devices. Sufficient curves shall be used to clearly indicate the coordination achieved between devices. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Plot the specific time-current characteristics of each protective device in such a manner that the upstream devices will be clearly depicted on the sheet.
- E. The plots shall include complete titles, representative One Line Diagram and legends, associated power company's relays or fuse characteristics, and complete parameters of transformers. There shall be a maximum of eight protective devices per sheet.
- F. The following specific information shall also be shown on the coordination curves:
  - 1. Device identifications.
  - 2. Time and current ratio for curves.
  - 3. Fuse, circuit breaker, and relay curves, showing complete operating bands of low-voltage circuit breaker trip curves.
  - 4. Cable damage curves.
  - 5. ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91 and transformer damage curves.
  - 6. Motor starting curves
  - 7. Significant maximum symmetrical or asymmetrical short circuit cutoff point.
  - 8. Electric utility's relays and/or fuses including manufacturer's minimum melt, total clearing, tolerance.
  - 9. Medium voltage equipment relays.
  - 10. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
  - 11. Low voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
  - 12. Pertinent transformer full-load currents at 100 and 600 percent.
  - 13. Ground fault protective device settings.
  - 14. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center and panelboard.
- G. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:
  - 1. Device identification.
  - 2. Current transformer ratio, relay tap, time delay, and instantaneous pickup.
  - 3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
  - 4. Fuse rating and type.
  - 5. Ground fault pickup and time delay

### PART 3 - ANALYSIS

Analyze the short circuit calculations and highlight any equipment that is determined to be underrated as specified or not coordinated. Propose approaches to effectively protect any equipment found to be underrated

After developing the coordination curves, highlight areas lacking coordination. For each sheet, present a technical evaluation with a discussion of any recommended compromises for best coordination.

### PART 4 - REPORT

The results of the power system study shall be summarized in a final report. The report shall include the following sections:

- A. Introduction, executive summary and recommendations, assumptions, impedance One Line Diagram and copies of the project One Line Diagram.
- B. Tabulations of equipment ratings versus calculated short circuit values and X/R ratios, and commentary regarding same.
- C. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- D. Copies of the manufacturers time current curves for the devices studied and plotted on the time current curves.
- E. CD with system model/data base files from the software used in the study.

### PART 5 - FIELD SETTINGS

- A. This contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The setting shall be in accordance with the approved Short Circuit and Protective Device Coordination Study.
- B. Necessary field setting of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved Short Circuit and Protective Device Coordination Study shall be carried out by the contractor at no additional cost to the owner.

END OF SECTION 260573

SECTION 260574 - ARC FLASH HAZARD STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 0 and 1 and Sections 26 6000 and 26 7000 Specifications apply to work of this section.

1.2 DESCRIPTION

- A. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the One Line Diagram. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the One Line drawing. This includes switchgear, switchboards, panelboards, motor control centers, PDUs, UPS, ATSS, and transformers. The study shall include creation of Arc Flash Hazard Warning Labels. The labels shall be printed on self-adhesive color nylon or vinyl die cut stock. The electrical contractor shall provide and install the labels.

Calculated Incident Energy at indicated working distance

Equipment Rated Voltage & Required Electrical Glove Class

Flash Hazard Boundary – Threshold at which burn level exceeds 1.2 cal/cm<sup>2</sup>

<b>! WARNING</b>	
<b>QUALIFIED WORKERS ONLY PPE REQUIRED</b>	
<b>ARC FLASH AND SHOCK HAZARD PRESENT</b>	
Arc flash boundary	18.41 in
Incident energy at working distance of	1.24 cal/cm <sup>2</sup> 18 in
Nominal system voltage	208 VAC
Insulating glove class with leather protectors	00
Shock hazard when covers removed	
Limited approach boundary	42 in
Restricted approach boundary	12 in
Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements	
By:	Phone:
Equipment: <b>SAMPLE 1</b>	Date: (Label Number)

Shock Hazard Boundaries (based on equipment voltage Rating)

PPE Level and PPE Requirements (Refer to Table 1.3.6.1)

PPE Level: **3** Min. Arc Rating: 12 cal/cm<sup>2</sup>

Minimum PPE Requirements:

- Arc-rated long-sleeve shirt & arc-rated pants and/or arc-rated coverall and/or arc flash suit all with total system arc rating of at least 12 cal/cm<sup>2</sup>. Arc-rated face shield & arc-rated balaclava or arc-rated arc flash suit hood with arc rating of at least 12 cal/cm<sup>2</sup>.
- Hard hat, safety glasses, hearing protection (ear canal inserts), arc-rated gloves & leather work shoes.
- (Arc-rated hard hat liner, arc-rated rainwear) as needed.

Example of Arc Flash Warning Label

- B. The Arc Flash Hazard Study shall include the electrical distribution system equipment shown on the One Line Diagram. Use the data from the Fault/Coordination Study from Specification Section 260573 to perform the Arc Flash Hazard Study. The Arc Flash Hazard Study shall consider operation during normal conditions alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard.

### 1.3 QUALIFICATIONS

- A. The Contractor shall have the study prepared by a Registered Professional Electrical Engineer (licensed in the State of California) who has at least ten (10) years of experience in performing power system studies.
- B. The arc flash hazard study shall be performed using EasyPower or ETAP for Windows computer software packages.

### 1.4 SUBMITTALS

- A. The contractor shall submit the Arc Flash Hazard Study and arc flash warning labels at least 30 days prior to energizing the electrical equipment.
- B. Submit three (3) copies of the power systems study and (1) set of warning labels.

## PART 2 - EXECUTION

### 2.1 SHORT CIRCUIT STUDY

- A. Perform a Short Circuit Study as specified in Section 26 0573.

### 2.2 PROTECTIVE DEVICE COORDINATION STUDY

- A. Perform a Protective Device Coordination Study as specified in Section 26 0573.

### 2.3 ARC FLASH HAZARD STUDY

- A. Perform an Arc Flash Hazard Study using data from the completed Short Circuit and Protective Device Coordination Studies.
- B. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
- C. The study shall be in accordance with applicable NFPA 70E, OSHA 29-CFR, Part 1910 Sub part S and IEEE 1584 Standards.
- D. Determine the following
  1. Flash Hazard Protection Boundary
  2. Limited Approach Boundary
  3. Restricted Boundary
  4. Prohibited Boundary
  5. Incident Energy Level
  6. Required Personal Protective Equipment Class
  7. Type of Fire Rated Clothing

- E. Produce an Arc Flash Warning label listing items 1 – 7 above. Also, include the bus name and voltage. The labels shall be printed on self-adhesive color nylon or vinyl die cut stock.
- F. Produce Arc Flash Evaluation Summary Sheet listing the following additional items:
  - 1. Bus Name
  - 2. Upstream Protective Device Name, Type, and Settings
  - 3. Bus Line to Line Voltage
  - 4. Bus Bolted Fault
  - 5. Protective Device Bolted Fault Current
  - 6. Arcing Fault Current
  - 7. Protective Device Trip / Delay Time
  - 8. Breaker Opening Time
  - 9. Solidly Grounded Column
  - 10. Equipment Type
  - 11. Gap
  - 12. Arc Flash Boundary
  - 13. Working Distance
  - 14. Incident Energy
  - 15. Required Protective Fire Rated Clothing Type and Class

### PART 3 - ANALYSIS

Analyze the Short Circuit and Protective Device Coordination, and Arc Flash Hazard calculations and highlight any equipment, which is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels. The proposed major corrective modifications shall be taken, under the advisement of the Engineer and the Contractor will be given further instructions.

### PART 4 - REPORT

The results of the power system study shall be summarized in a final report. The report shall include the following sections:

- A. Introduction, executive summary and recommendations, assumptions and a reduced copy of the One Line Diagram.
- B. Arc Flash Evaluations Summary Spreadsheet.
- C. Bus Detail Sheets.
- D. Arc Flash Hazard Warning Labels printed on self-adhesive color nylon or vinyl die cut stock.
- E. CD with system model and database file from the software used in the study.

END OF SECTION 260574

## SECTION 260943 - NETWORK LIGHTING CONTROLS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 0 and 1 and Sections 266000 and 267000 specifications apply to work of this section.

#### 1.2 SUMMARY

- A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
- C. All system devices shall be networked together enabling digital communication and shall be individually addressable.
- D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
- E. The system architecture shall facilitate remote operation via a computer connection.
- F. The system shall not require any centrally hardwired switching equipment. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

#### 1.3 DEFINITIONS

- A. NA

#### 1.4 SUBMITTALS

- A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)
- B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
- C. Other Diagrams – as needed for special operation or interaction with other system(s)
- D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
- E. Hardware and Software Operation Manuals
- F. Other operational descriptions as needed

#### 1.5 QUALITY ASSURANCE. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

- B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

- C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

#### 1.6 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

#### 1.7 WARRANTY

- A. All devices in lighting control system shall have a 5 year warranty.

### PART 2 – PRODUCTS

- 2.1 MANUFACTURERSA. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, [www.sensorswitch.com](http://www.sensorswitch.com)).
- 2.2 SYSTEM REQUIREMENTS A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
  - B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
  - C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see *Networked LED Luminaire* section)
  - D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.
  - E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
  - F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
  - G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

- H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.
- J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
- K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
- L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.
- M. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the “bridge” devices and all cabling that connects zones to bridge devices.
- N. WiFi enabled devices shall be able to detect when WiFi network is down and revert to a user directed default state.
- O. WiFi-enabled devices shall be capable of current monitoring
- P. WiFi-enabled devices shall utilize WPA2 AES encryption
- Q. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks
- R. WiFi-enabled devices shall have at least one local RJ-45 port for communicating with nonWiFi-enabled system devices
- S. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.
- T. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
- U. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or WiFi backbone.
- V. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
  - 1) Auto-On / Auto-Off (via occupancy sensors)

- a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
- 2) Manual-On / Auto-Off (also called Semi-Automatic)
- a. Pushing a switch will turn lights on.
  - b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
- 3) Manual-On to Auto-On/Auto-Off
- a. Pushing a switch will turn lights on.
  - b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
  - c. Sequence can be reset via scheduled (ex. daily each morning) events
- 4) Auto-to-Override On
- a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
  - c. Sequence can be reset via scheduled (ex. daily each morning) events
- 5) Manual-to-Override On
- a. Pushing a switch will turn lights on.
  - b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
  - c. Sequence can be reset via scheduled (ex. daily each morning) events.
- 6) Auto On / Predictive Off
- a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
- 7) Multi-Level Operation (multiple lighting levels per manual button press)
- a. Operating mode designed specifically for bi-level applications
  - b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
  - c. Eliminates user confusion as to which of two buttons controls which load

- d. Three different transition sequences are available in order to comply with energy codes or user preference)
- e. Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
- f. Depending on the sequence selected, every button push steps through relays states according to below table

Sequence State #	Alternating Sequence		Full On Sequence		3 Step On Sequence	
	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On
3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(\*step only present for devices without separate off button)

- g. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

- W. A taskbar style desktop application shall be available for personal lighting control.
- X. An application that runs on “smart” handheld devices (such as an Apple®iPhone®) shall be available for personal lighting control.
- Y. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.
- Z. Control software shall enable integration with a BMS via BACnet IP.
- AA. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS A. Control Module (Gateway)

- 1) Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
- 2) Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.

- 3) Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
- 4) Device shall automatically detect all devices downstream of it.
- 5) Device shall have a standard and astronomical internal time clock.
- 6) Device shall have one RJ-45 10/100 BaseT Ethernet connection.
- 7) Device shall have a USB port
- 8) Each control gateway device shall be capable of linking 1500 devices to the management software.
- 9) Device shall be capable of using a dedicated or DHCP assigned IP address.
- 10) Network Control Gateway device shall be the following Sensor Switch model Series: nGWY2

- B. Networked System Occupancy Sensors1) Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
- 2) Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
  - 3) For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
  - 4) Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
  - 5) All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
  - 6) Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
  - 7) Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.
  - 8) Sensors shall be available in multiple lens options which are customized for specific applications.
  - 9) Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
  - 10) All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
  - 11) All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
  - 12) Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
  - 13) Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
  - 14) Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
  - 15) Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.

- 16) Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- 17) Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
- 18) Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)
- 19) Wall switch sensors shall be available with optional raise/lower dimming adjustment controls
- 20) Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:

nWSD or nWSX (PIR, 1 Relay)  
nWSD PDT or nWSX PDT (Dual Tech, 1 Relay)  
nWSD NL (PIR w/ Night Light, 1 Relay)  
nWSD PDT NL (Dual Tech w/ Night Light, 1 Relay)  
nWSX NL LV (PIR w/ Night Light, No Relay)  
nWSD PDT NL LV (Dual Tech w/ Night Light, No Relay)  
nWSD LV or nWSX LV (PIR, No Relay, Raise/Lower Dim Ctrl)  
nWSD PDT LV or nWSX PDT LV (Dual Tech w/ Night Light, No Relay, Raise/Lower Dim Ctrl)

- 21) Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
- 22) Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
- 23) Embedded sensors shall have an optional photocell
- 24) Embedded sensors shall be the following Sensor Switch model number:

nES 7 (PIR, No Relay)  
nES 7 ADCX (PIR w/ Photocell, No Relay)  
nES PDT 7 (Dual Technology, No Relay)  
nES PDT 7 ADCX (Dual Technology w/ Photocell, No Relay)

- 25) Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
- 26) Fixture mount sensors shall be capable of powering themselves via a line power feed.
- 27) Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
- 28) Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
- 29) Sensors shall be the following Sensor Switch model numbers, with device options as specified

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCMR(B) 9	1	1	Standard	PIR
nCMR(B) 9 2P	2	2	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCMR(B) PDT 9	1	1	Standard	Dual
nCMR(B) PDT 9 2P	2	2	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCMR(B) 10	1	1	Extended	PIR
nCMR(B) 10 2P	2	2	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCMR(B) PDT 10	1	1	Extended	Dual
nCMR(B) PDT 10 2P	2	2	Extended	Dual
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCMR(B) 6	1	1	High Bay	PIR
nCMR(B) 6 2P	2	2	High Bay	PIR
nCMR(B) 6 480	1	2	High Bay	PIR

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

- 30) System shall have WiFi enabled fixture mountable sensors available.
- 31) Embedded sensors shall have an optional photocell and 0-10 VDC dimming output
- 32) WiFi enable sensors shall be one of the Sensor Switch model numbers:

nCMRB 6 WIFI (PIR, w/ Relay)  
nCMRB 10 WIFI (PIR, w/ Relay)  
nCMRB 50 WIFI (PIR, w/ Relay)  
nCMRB 9 WIFI (PIR, w/ Relay)

C. Networked System Daylight (Photocell and or Dimming) Sensors

- 1) Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
- 2) Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
- 3) Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- 4) Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
- 5) Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set- point" setting.)
- 6) Combination units that have all features of on/off photocell and dimming sensors shall also be available.
- 7) A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
- 8) Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
- 9) Sensor shall be the following Sensor Switch model numbers, with device options as specified:

nCM(B) PC (on/off)  
nCM(B) ADC (dimming)  
nCM(B) PC ADC (on/off, 0-10 VDC dimming)  
nCMR(B) PC (on/off, single relay)  
nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

- 10) Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
- 11) Embedded sensors shall be the following Sensor Switch model number:

nES ADCX (Dimming Photocell)

- D. Networked System Power (Relay) Packs1) Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2<sup>nd</sup> relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
- 2) Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
  - 3) All devices shall have two RJ-45 ports.
  - 4) Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
  - 5) Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
  - 6) When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
  - 7) Power Packs and Power Supplies shall be available that are WiFi enabled.
  - 8) Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
  - 9) Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.
  - 10) Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts/LED drivers.
  - 11) Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
  - 12) Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
  - 13) Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
  - 14) Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
  - 15) Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
  - 16) Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
  - 17) Specific Secondary Packs shall be available that control louver/damper motors for skylights.
  - 18) Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
  - 19) Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:
    - nPP16 (Power Pack w/ 16A relay)
    - nPP16 WIFI (Power Pack w/ 16A relay, WIFI enabled)
    - nEPP5 D (Power Pack w/ 5A relay and 0-10VDC dimming output)
    - nSP16 (Secondary Pack w/ 16A relay)
    - nSP5 2P (Secondary Pack w/ two 5A relays)
    - nSP5 D (Secondary Pack w/ 5A relay and 0-10VDC dimming output)
    - nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)

nSP5 D ER (UL924 Listed Secondary Pack w/ 5A relay and 0-10VDC dimming output for switching emergency power circuits)  
nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)  
nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)  
nSP5 PCD MLV (Secondary Pack w/ 5A relay and magnetic low voltage dimming output)  
nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)  
nSP5 480 (Secondary Pack w/ 5A relay for switching 208/240/480 VAC loads)  
nSP5 2P LVR (Louver/Damper Control Pack)  
nSHADE (Pulse On/Off Control Pack)  
nPS 80 (Auxiliary Bus Power Supply)  
nPS 80 WIFI (Auxiliary Bus Power Supply, WiFi enabled)  
nAR 40 (Low voltage auxiliary relay pack)

- E. Networked System Relay & Dimming Panels1) Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
- 2) Relays shall be rated to switch up to a 30A ballast load at 277 VAC. Panel shall provide one 0-10VDC dimming output paired with each relay.
  - 3) Panel shall power itself from an integrated 120/277 VAC supply.
  - 4) Panel shall be capable of operating as either two networked devices or as one.
  - 5) Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
  - 6) Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
  - 7) Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:  
  
nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)  
nPANEL 2 480 (Panel w/ two dual phase relays (208/240/480 VAC) and two 0-10 VDC dimming outputs)

- F. Networked Auxiliary Input / Output (I/O) Devices
- 1) Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.
  - 2) Devices shall have two RJ-45 ports
  - 3) Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
  - 4) Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
  - 5) Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
  - 6) Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
  - 7) Specific I/O devices shall sense state of low voltage outdoor photocells
  - 8) Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
  - 9) Specific I/O devices shall sense .
  - 10) Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:

nIO D (I/O device with 0-10 dimming output)  
nIO 1S or nIO RLX (I/O device with contact closure or 0-10VDC dimming input )  
nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in nIO PC KIT only)  
nIO X (Interface device for communicating with RS-232 enabled AV Touch Screens

#### G. Networked LED Luminaires

- 1) Networked LED luminaire shall have a mechanically integrated control device
- 2) Networked LED luminaire shall have two RJ-45 ports
- 3) Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
- 4) Networked LED luminaire shall provide low voltage power to other networked control devices
- 5) System shall be able to turn on/off LED luminaire without using a relay
- 6) System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
- 7) System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
- 8) LED Luminaires shall be the following Lithonia model families:

RTLED  
TLED  
VLED  
ACLED  
AL LED  
WLED  
STLED  
MINO

#### H. Networked System Wall Switches & Dimmers

- 1) Devices shall recess into single-gang switch box and fit a standard GFI opening.
- 2) Devices shall be available with zero or one integrated Class 1 switching relay.
- 3) Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- 4) All sensors shall have two RJ-45 ports.
- 5) All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
- 6) Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
- 7) Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
- 8) Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
- 9) Devices with mechanical push-buttons shall provide tactile and LED user feedback.
- 10) Devices with mechanical push-buttons shall be made available with custom button labeling
- 11) Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
- 12) Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:

nPOD (single on/off, capacitive touch, audible user feedback)  
 nPOD 2P (dual on/off, capacitive touch, audible user feedback)  
 nPODR (single on/off, one relay, capacitive touch, audible user feedback)  
 nPODM (single on/off, push-buttons, LED user feedback)  
 nPODM 2P (dual on/off, push-buttons, LED user feedback)  
 nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)  
 nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)  
 nPODM 4P (quad on/off, push-buttons, LED user feedback)  
 nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

I. Networked System Graphic Wall Station

- 1) Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
- 2) Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
- 3) Device shall enable user supplied .jpg screen saver image to be uploaded.
- 4) Device shall surface mount to single-gang switch box
- 5) Device shall have a micro-USB style connector for local computer connectivity.
- 6) Device shall have two RJ-45 ports for communication
- 7) Device shall be the following Sensor Switch model number: nPOD GFX

- J. Networked System Scene Controllers1) Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
- 2) Device shall recess into single-gang switch box and fit a standard GFI opening.
  - 3) Devices shall provide LED user feedback.
  - 4) Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
  - 5) All sensors shall have two RJ-45 ports.
  - 6) Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
  - 7) Device shall be capable of selecting a lighting profile be run by the system’s upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
  - 8) Device shall have LEDs indicating current selection.
  - 9) Scene Selector device shall be the following Sensor Switch model number:

nPODM 2S (2 Scene, push-button)  
 nPODM 4S (4 Scene, push-button)  
 nPODM 4S DX (4 Scene, push-button, On/Off/Raise/Lower)  
 nPODM 4L DX (4 Adjustable Presets, push-button, On/Off/Raise/Lower)

- K. Communication Bridges1) Device shall surface mount to a standard 4" x 4" square junction box. Device shall have 8 RJ-45 ports.
- 2) Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
- 3) Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
- 4) Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
- 5) Communication Bridge devices shall be the following Sensor Switch model numbers:  
nBRG 8 (8 Ports)

2.4 LIGHTING CONTROL PROFILESA. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

- B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
- C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
- D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
- E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.
- F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.
- G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
- H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
- I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
- J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

#### 2.5 MANAGEMENT SOFTWARE

- A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software
- B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

- C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
- D. A printable network inventory report shall be available via the software.
- E. A printable report detailing all system profiles shall be available via the software.
- F. Software shall require all users to login with a User Name and Password.
- G. Software shall provide at least three permission levels for users.
- H. All sensitive stored information and privileged communication by the software shall be encrypted.
- I. All device firmware and system software updates must be available for automatic download and installation via the internet.
- J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

## 2.6 BMS COMPATIBILITY

- A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.
- B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.
- C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

## 2.7 SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

- A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.
- B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
- C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO<sub>2</sub>.
- D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).
- E. Energy savings data shall be calculated for the system as a whole or for individual zones.
- F. A time scaled graph showing all relay transitions shall be presented.
- G. A time scaled graph showing a zones occupancy time delay shall be presented
- H. A time scaled graph showing the total light level shall be presented.
- I. User shall be able to customize the baseline run-time hours for a space.

J. User shall be able to customize up to four time-of-day billing rates and schedules.

K. Data shall be made available via a .CSV file

## 2.8 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

END OF SECTION 260943

## SECTION 266000 - GENERAL CONDITIONS FOR ELECTRICAL WORK

### PART 1 - ORDINANCES, REGULATIONS AND CODES

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions, Divisions 0 and 1, specifications apply to work of this section.

1.2 All work must conform to the requirements which fall within the scope of the regulations in the Codes or under the jurisdiction of any of the governing bodies listed.

- A. The California Code of Regulations, Titles 19 thru 24.
- B. The California Electrical Code as applicable under current state and local regulations (latest edition and supplements).
- C. State Board of Health.
- D. CAL-OSHA Regulations.
- E. Nothing in these Specifications or shown on the plans, shall relieve the Contractor from full compliance with applicable portions of any of the above regulations pertaining to work which he is installing under this Contract.

#### 1.3 PERMITS AND FEES

Pay for and obtain all permits, inspection fees, etc., as required for the completion of all work included in this Contract. Any inspection Certificates required shall be obtained and delivered to the Owner.

#### 1.4 EXAMINATION OF DRAWINGS AND SITE

Before submitting his bid, the Contractor shall carefully examine the Architectural, Structural, Mechanical and Plumbing Drawings for this work, along with the Specifications for same in addition to the drawings and specifications governing the work of this trade. He shall also visit the site of the proposed construction and familiarize himself with all the site conditions. No subsequent allowances will be made to the Contractor because of his negligence in complying with the above or his alleged inability to understand the requirements.

#### 1.5 CONDUCT OF THE WORK

The Contractor shall maintain on the job a competent foreman or a superintendent at all times to superintend the work.

#### 1.6 CONTRACTOR'S RESPONSIBILITY

The Contractor shall be responsible for the safety and good condition of all materials and equipment until final acceptance by the Owner. He shall erect and maintain suitable barriers, protective devices, lights and warning signs where required for the protection of the public and employees about the buildings. He shall be fully responsible for any loss or injury to persons or property resulting from his neglect or the carelessness and neglect of his employees.

## 1.7 SUBMITTALS

- A. Shop drawings of power and signal service and distribution equipment and lighting fixture catalog cuts shall be submitted for approval in seven (7) bound copies.
- B. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identical by the mark number as indicated on drawings.
- C. Equipment or material furnished or incorporated in construction without prior approval of the Architect may be rejected and if rejected shall be removed from the structure and replaced with approved equipment or material at the Contractor's expense.

## 1.8 RECORD DRAWINGS

See General Conditions.

## 1.9 CATALOG DATA AND OPERATING INSTRUCTIONS

Upon completion of the work in this Contract, the Architect shall be furnished with a complete set of catalog data which describes each piece of equipment installed under this Contract. The catalog shall be bound in a set and shall be clearly labeled as to each item of equipment used.

## **PART 2 - LOCATIONS**

2.1 The work as laid out is to some extent diagrammatic, and the location thereon indicated may be approximate only. The Contractor, therefore, shall install all the equipment, apparatus, conduit runs and the like as follows:

- A. Adhere to the location indicated as far as possible.
- B. Maintain ample head room in all rooms and passageways, clearance around all apparatus and equipment and under pipe lines for unrestricted passage and for easy servicing of all apparatus, equipment, devices and the like.
- C. Verify the exact locations of all fixtures and other apparatus or devices as indicated on the drawings. In the event these drawings do not sufficiently indicate the locations for all such fixtures, apparatus or devices, the Contractor shall obtain the exact locations from the Architect.

## 2.2 VERIFICATION OF DIMENSIONS

- A. The Contractor shall, as work progresses, verify the dimensions of the spaces available for the installation of the work and he shall assume full responsibility for the proper locations and grading of each portion thereof.
- B. Where the work requires connections to be made to equipment that is furnished and set in place by others, the Contractor shall obtain exact locations and rough-in dimensions from the manufacturer of such equipment and he shall install the connections in a neat and workmanlike manner.

## 2.3 CUTTING AND PATCHING

This Contractor shall do all cutting and patching of the work for the installation of the equipment and materials as approved by the Architect and/or Engineer. All patching shall accurately match the adjoining work.

## 2.4 BORING

- A. Provide mechanical boring equipment to bore under existing asphalt, concrete, or other surfaces or objects as noted on the drawings. All borings shall be a minimum of 24" under the substrate material unless otherwise authorized by the Architect.
- B. Holes shall be bored not to exceed 1" larger diameter than the largest component remaining in the excavation.
- C. Water or air pressure jetting are not permitted, unless they comply with the following requirements:
  - 1) All surfaces of the hole can be visually inspected with 6' maximum length.
  - 2) All objects shall be supported continuously to prevent sagging.
  - 3) The hole shall be filled with compacted damp sand and inspected by the Project Inspector or Materials Testing Lab technician.

## 2.5 FOUNDATIONS AND SUPPORTS

This Contractor shall provide all foundations, supports and hangers, etc., as required to install the equipment as specified or shown on the drawings. All equipment shall be supported, braced and cross-braced in such manner as to prevent sway and/or lateral movement.

## 2.6 EXCAVATION AND BACKFILLING

- A. Excavating required for the installation of the work shall be done by this Contractor. Underground lines outside the buildings shall be installed with a minimum cover of 24" except depth of utility services shall comply with respective utility company requirements.
- B. The conduit shall be laid on material described below to afford bearing for the full length of the conduit. Any part of the trench excavated below grade shall be corrected with thoroughly compacted material approved by the Architect.
- C. When the bottom uncovered at subgrade is soft and, in the opinion of the Architect, cannot support the conduit, a further depth shall be excavated and refilled to conduit foundation grade as required by the Architect.
- D. Backfill:
  - 1) 6" Below, Around, and to 6" Above Conduit: Material shall be sand. Place carefully around and on top of conduit, taking care not to disturb conduit. Consolidate with vibrator.
  - 2) 6" Above Conduit to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used,

subject to review by Engineer.

- E. No excavation below the level of, or adjacent to, foundations of footings shall be made except in a manner approved by the Architect.
- F. A red or yellow tracer tape stating "CAUTION ELECTRIC LINE BURIED BELOW" shall be installed 12" above conduit, full length of trench.
- G. Electrical conduit shall not be run in excavations provided for plumbing or heating pipes, unless separated by a minimum of 12 inches.
- H. Verify location of all underground lines with Owner and utility companies before starting excavation. If any utility company facilities are identified and located within the perimeter of the building, the Contractor shall stop work, promptly notify the Architect and secure his instructions.
- I. Ten (10) days before doing any excavation or trenching, contact "Underground Service Alert," 1-800-642-2444, advise them of work schedule and comply with their recommendations.

## 2.7 CLEANING UP

- A. The Contractor shall keep the premises free from accumulations of his waste material or rubbish. At the completion of the work, he shall remove all his rubbish, tools, scaffolding and surplus materials from and about the buildings, leaving the premises in a clean condition.
- B. All exterior surfaces of exposed equipment and material shall be thoroughly cleaned of all dirt, cement, plaster and other debris, including the exterior surfaces of all conduit, conduit fittings, conduit hangers, insulation and the like.
- C. All surfaces to be painted shall be carefully wiped or otherwise cleaned; cracks and corners scraped out clean, grease and oil spots removed so that surfaces may receive paint without further preparation.
- D. All fixtures and plated materials shall be thoroughly cleaned and polished.

## 2.8 DAMAGE BY BREAKS

The Contractor shall be responsible for all damage to any part of the premises caused by breaks in conduit or fixtures furnished and/or installed by him under this specification for a period of one (1) year from date of acceptance of the project by the Owner.

## 2.9 SITE CONDITIONS

- A. Where existing utilities are shown on the plans, extreme care shall be exercised in excavating near these utilities to avoid any damage thereto, and the Contractor shall be held responsible for any such damage caused by this operation.
- B. The general location and arrangement of conduit, equipment apparatus, etc., as shown in the drawings or herein specified and all installations shall be made in accordance therewith. Information on the drawings relative to existing services is approximate only. Minor deviations required to conform to actual locations shall be made without additional cost to Owner.

- C. Should existing utilities, not shown on the plans, be found during excavations, or identified, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage there arising from his operations after discovery of such utilities not shown on the plans. These utilities shall be removed or relocated as directed by the Architect. An equitable adjustment in the Contract will be made for the additional work involved.
- D. The Contractor shall use special precautions where excavations are made in the areas near electrical ducts since they may be high voltage ducts. All such ducts shall be exposed by careful hand excavation so as not to damage the ducts or cause injury to personnel and shall be suitable marked with warning signs, barricades, etc. as required.

#### 2.10 STANDARD PRACTICE

All work not shown in complete details shall be installed in conformance with the best standard practice for the trade.

#### 2.11 INTENT

It is the intention to provide systems that are complete in every respect without further cost to the Owner. Anything not shown in drawings, or indicated in the specifications, but required for complete operating systems shall be included as part of this Contract. This shall include all connections to existing services.

#### 2.12 SPECIAL NOTE

Attention of Contractor is hereby called to all work covered by notes on the drawings. Work covered by notes must be furnished and installed whether it is specifically mentioned in these specifications or not.

#### 2.13 GUARANTEE

Except as otherwise specified, all materials, apparatus equipment furnished and installed under the Electrical Section of this specification shall be new and free from all defects. Should any trouble develop within a period of one (1) year from date of acceptance of the work, due to inferior or faulty material and/or workmanship, the trouble shall be corrected and material and equipment replaced by the Contractor without expense to the Owner.

#### 2.14 SERVICES

The location of any existing utility services shown on the drawings is approximate and shall be checked by this Contractor for exact location. Refer to "EXCAVATION AND BACKFILLING" for additional requirements.

#### 2.15 LIST OF MATERIALS

Within thirty (30) calendar days after the award of the Contract, the Contractor shall submit seven (7) copies of a complete list of materials to be installed under this Contract, giving, in the case of each item of material to be used, the name of the article. All substitutes must be approved by the Architect as stipulated in Section 01620.

## 2.16 ACCESS OPENINGS

It shall be the responsibility of the Contractor to provide sufficient and convenient access openings, panels, etc., in the building construction where required for the maintenance of, installation and/or removal of all equipment, or other items of the various systems and equipment.

## 2.17 PURCHASE ORDERS AND ACCEPTANCE

- A. The Contractor shall file with the Architect two (2) certified copies of all purchase orders, for materials, equipment, appliances and rentals thereof within two (2) weeks from date of Notice to Proceed with the Contract if requested by the Architect.
- B. The Contractor shall file with the Architect two (2) certified copies of acceptance of purchase orders for materials, equipment, and appliances by the manufacturer, distributor or wholesale house within six (6) weeks from the date of Notice to Proceed with the Contract if requested by the Architect.
- C. Failure to provide same within the stipulated time shall be deemed sufficient cause for the Architect to withhold certificates of payment for work completed or materials and equipment provided by the Contractor or his subcontractors toward the completion of their Contracts.

END OF SECTION 266000

## SECTION 267000 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 0 and 1 and Section 266000 specifications apply to work of this section.

#### 1.2 SCOPE OF WORK

- A. This portion of the work includes the furnishing of all labor and materials necessary for the complete wiring system to outlets and all equipment shown on the drawings or covered by this Section of the Specifications or other Division 26 and Division 28 sections of Specifications. In general, the work includes the following:
  - 1. Complete system of conduits, substructures and equipment for power, telephone and cable television services. The Electrical Contractor shall inform the respective utility companies that the project has been started and confirm that all forms, which are required for the Application for Service, have been completed and submitted to the Utility Company. The Electrical Contractor shall obtain a copy of the approved engineering drawings prior to construction.
  - 2. Complete system of branch circuit wiring, conduit and distribution equipment for lights, receptacles and power.
  - 3. Furnish and install lighting panelboards, lamps, lighting fixtures, wall switches, convenience outlets, etc. as shown on drawings.
  - 4. All hangers, anchors, sleeves, chases and supports for fixtures, all electrical equipment and materials.
  - 5. Furnish, install and connect wire, conduit and switches, etc. required for other equipment covered by other sections of these Specifications.
  - 6. All excavating and backfill as required for electrical work.
  - 7. The patching and repair of all work modified or damaged by the installation of work under this contract.
  - 8. Outlet boxes and conduit system for telecommunications (voice and data..
  - 9. Demolition work.
  - 10. Terminal cabinets and backboards.
  - 11. The Contractor shall furnish and install all work necessary to make complete systems, whether or not such details are mentioned in these Specifications or shown on the drawings, but which are necessary in order to make complete working systems, excepting only those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed by other Contractors.
  - 12. Electrical Contractor must coordinate his work with the work of other trades so as to provide raceways, conductors and outlets in the correct location for the equipment served, including all built-in appliances, mechanical, and signal equipment and connect same. Electrical Contractor must provide power of the correct voltage and phase to each item of equipment.

13. Before construction starts, the electrical contractor shall arrange a coordination meeting with the General contractor and all other sub contractors supplying equipment that requires electrical connections. All electrical requirements shall be verified and any problems shall be immediately reported to the architect. Equipment items to verify shall include but not be limited to: Voltage, amps, phase, location, orientation, space requirements, type of connection, starter and disconnect location and provision, control system operation and requirements, etc.
14. The above list is given for the convenience of the contractor and is not considered all-inclusive.

### 1.3 TEMPORARY CONSTRUCTION POWER

- A. Provide a temporary construction power system that is adequate for this project. Coordinate requirements and details with the general contractor. All 120V, 15A and 20A receptacles shall have ground fault circuit interrupter protection.

### 1.4 WORK NOT INCLUDED

- A. The furnishing and installation of motors.
- B. Access panels.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. All materials, appliances and equipment except that furnished by the Owner shall be new, bear U.L. Label and of the make, brand or quality specified or as accepted by the Architect as herein provided. This shall also apply to all parts of the work whether or not this particular paragraph is referred to by number.
- B. All apparatus, conduit systems, etc., shall be installed and interconnected so as to form complete systems as herein specified and/or shown on all the accompanying drawings. This contractor shall furnish and install all work necessary to make complete working systems, excepting only those portions that are specifically mentioned herein or plainly marked on accompanying drawings as being furnished by other contractors.

### 2.2 MAIN SWITCHBOARD

- A. Dead front, dead rear, floor standing, consisting of underground pull section, main section with main circuit breaker and equipment to accommodate power company's current transformer and meter, distribution section and sub-feed circuit breakers as shown on drawings. Main switchboard shall be as manufactured by Square D, General Electric, Eaton, Siemens or approved equal.
- B. Circuit breakers shall be molded case type, quick-make, quickbreak, with thermal magnetic trip. Size and rating shall be as shown on the drawings. All circuit breakers shall be bolt-on type. Two and three pole breakers shall have integral internal common trip. All circuit breakers, rated 100 amps and larger, shall be equipped with adjustable instantaneous trip settings.

- C. Finish shall be one coat of rust-inhibiting primer and two coats of gray enamel.
- D. Full-size buses shall extend the full height of the distribution section. A copper ground bus shall be provided firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
- E. Section or sections shall be fully bussed with either copper or tin-plated aluminum bussing with all hardware in place for future devices. The bussing shall be braced to withstand the fault current of 50,000A symmetrical minimum. Filler plates as required shall be supplied with two handles on each plate. Sub-feed devices shall be of the types indicated on the drawings and shall be lockable in the "Open" position. A nameplate shall be supplied for each device in each section of each switchboard affixed to the switchboard trim adjacent to device and indicating name of device as shown one line diagram. Black letters shall be minimum 3/4" high on white micarta tabs.
- F. All circuit breakers in main switchboard shall have short circuit current interrupting capacity exceeding the maximum available at service transformer. Contractor shall be responsible for obtaining fault current information from serving Utility Company prior to fabrication of main switchboard. The main switchboard shall have an integrated short circuit current interrupting rating of minimum of 30,000A symmetrical, or greater if indicated on drawings.
- G. Underground pull sections shall be manufactured by the same manufacturer of the switchboard and per the serving Utility Company's requirements.
- H. The Electrical Contractor shall submit three (3) copies of the main switchboard shop drawings to the Serving Utility Company for their approval prior to fabrication of the main switchboard.

### 2.3 PANELBOARDS

- A. The panelboards shall be constructed in accordance with the standard set up by the Underwriters' Laboratories, Inc., and as manufactured by Square "D", General Electric, Eaton, Siemens or approved equal, and each shall contain the number and type of circuit breakers as indicated on the drawings. All circuit breakers, rated 100 amps and larger, shall be sub-feed type and equipped with adjustable instantaneous trip settings.
- B. The panelboards shall be equipped with a hinged lockable door, piano hinged trim and typewritten circuit directory. All finish in offices, corridors or areas subject to public view shall be prime coat for finish coat by painter. In storage rooms, equipment rooms, etc., finish shall be standard factory gray Hammertone. Provide a flush lock on all panelboards.
- C. Any panel with an isolated ground bus shall have a nameplate stating "IG CIRCUITS". Nameplate to be same size and color and adjacent to panel designation nameplate.
- D. Seven copies of detailed construction drawings for the panelboards and terminal cabinets shall be submitted to the Architect for Approval before their construction is started.

### 2.4 TRANSIENT VOLTAGE SURGE SUPPRESSORS

- A. Surge suppressors shall be Transient Voltage Surge Suppressor (TVSS) AC type, and shall meet or exceed UL 1449, ANSI IEEE C62.41 Categories A, B and C for switchboards and panels and ANSI IEEE C62.41 Categories A and B for duplex receptacles.
- B. Provide TVSS at locations shown on drawings as described below:

- C. Main and Distribution Switchboards and Panelboards –
  - 1. Suppression shall be included and factory mounted within the panelboard by the manufacturer of the panelboard, using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVSS equipment shall be Eaton, Square D “XGA” series, G.E. “Tranquell” series or approved equal.
  - 2. Duplex Receptacles - Leviton #5380-IG-O or approved equal.
- D. All TVSS equipment shall have built-in diagnostics and shall indicate when the equipment is not providing the intended protection.

## 2.5 MOTOR CONTROL CENTERS

- A. Motor Control Center shall be Square “D” Company Model 6, General Electric, Eaton or approved equal, and shall consist of one or more enclosed vertical sections joined together to form a rigid, free standing assembly. The construction of the Motor Control Center shall meet the requirements set forth by Underwriters’ Laboratories publication UL 845, NEMA publication number ICS-3 Part 1 and National Electrical Code. Motor Control Center shall be suitable for operation for the type of service as indicated on drawings. The enclosure shall be NEMA 1 or 3R as required.
- B. Buses shall be made of tin-plated aluminum.
- C. Combination starter units in each vertical section shall consist of full voltage magnetic starters, thermal magnetic molded-case circuit breakers, and auxiliary control devices, as required and as shown on plans. All auxiliary equipment, except that which is specified for mounting on the door, shall be mounted within the compartment. Each unit shall be provided with unit door, unit support pan, unit saddle, and unit disconnect operator.
- D. Each combination starter unit shall have a door securely mounted with rugged concealed-type hinges that allow the door to swing open a minimum of 112 degrees for ease of unit maintenance and withdrawal. Each unit door shall be interlocked with its disconnect mechanism to prevent the door from opening when the unit is energized. A defeater mechanism shall be provided for defeating this interlock by authorized personnel. Removable door panels held with captive type screws shall be provided on starter unit doors for mounting push buttons, HOA selector switches and pilot lights. Each starter unit door shall house an external low-profile overload reset button for resetting the overload relay in the event of tripping. Each unit shall have its own 120 volt control transformer.
- E. Full voltage, non-reversing magnetic starters shall be furnished in all combination starter units, NEMA sizes as indicated on drawings.
- F. Thermal overload relays on starters shall be non-compensated bimetallic type with selector for either auto or manual reset. Overload heater units shall be provided in each leg of starter unit. Each starter shall have 2 auxiliary contacts, 120 volt control transformer, HOA switch and stop, run pilot lights.
- G. A control center identification nameplate with full factory identification numbers and characteristics shall be fastened on the vertical wire through door of every section. Each control center unit shall have its own identification nameplate fastened to the unit saddle.
- H. Motor control center wiring shall be NEMA class I, type B.

## 2.6 MAGNETIC STARTERS

- A. Motor Starters shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes and horsepower ratings, mounted in general purpose enclosures, or NEMA 3R as required. All starters shall be full voltage, non-reversing, unless otherwise noted. Thermal overload relays on starters shall be non-compensated bimetallic type with selector for either auto or manual reset. Overload heater units shall be provided in each leg of starter unit. Each starter shall have 2 auxiliary interlock contacts.
- B. Each starter shall have 120 volt control transformer and HOA selector switch mounted on cover.

## 2.7 TERMINAL CABINETS

- A. Terminal cabinets shall be flush or surface mounted as indicated with hinged doors and lock. The exterior finish to be same as for panelboards. Provide 3/4" plywood backing inside of cabinet. Provide proper number of terminals in cabinets as required.
- B. Provide a Bakelite nameplate fastened with screws or rivets to the face of each terminal cabinet that will identify it.
- C. Provide circuit directory and holder on inside of door with one line for each conductor entering and each conductor leaving cabinet.

## 2.8 RACEWAYS AND FITTINGS

- A. Shall be as manufactured by Alled Tube and Conduit Corporation, AFC Cable Systems, Inc., Carlon, Cantex, PW Pipe or approved equal.
- B. Galvanized rigid steel conduits (RSC. may be used in all locations.
- C. For underground runs in direct contact with earth, conduit shall be wrapped with PVC tape or shall have factory applied PVC coating.
- D. Galvanized intermediate metallic conduit (IMC. may be used in indoor locations not in direct contact with earth.
- E. Galvanized electrical metallic tubing (EMT) may be used in indoor dry locations in which it is:
  - 1. Not subject to physical damage.
  - 2. Not in direct contact with earth.
  - 3. Not in concrete slabs.
  - 4. Not in hazardous areas.
  - 5. On roof or walk cover when specifically shown on drawings.
  - 6. In masonry walls, not in same cells as rebars.
- F. Non-metallic rigid conduit shall be PVC Schedule 40 and may be used:
  - 1. Underground.
  - 2. Below concrete slab on grade.
  - 3. In concrete slab on floors above grade.
  - 4. In masonry walls, not in same cells as rebars.
- G. Flexible steel conduit may be used in dry locations for final connections to:
  - 1. Motors, transformers and other mechanical equipment, not to exceed 18 inches.

2. Lighting fixtures, not to exceed 72 inches.
  3. Facilitate wiring in tight locations, when approved by Engineer.
- H. Flexible aluminum conduit may be used in walls or in attics to facilitate wiring in tight locations, when approved by the Engineer.
- I. Liquidtight flexible steel conduit shall be used in outdoor or wet locations for final connection to motors or other mechanical equipment, not to exceed 18 inches.
- J. Fittings:
1. For rigid and intermediate steel conduits, fittings shall be:
    - a. Galvanized rigid steel threaded type.
    - b. Provide insulated grounding bushings at switchboard enclosures and panel enclosures for feeders.
  2. For electrical metallic tubing (EMT), fittings shall be:
    - a. Zinc plated steel set screw type in dry locations.
    - b. Zinc plated steel compression type for conduits larger than 1", in wet locations and in masonry walls.
    - c. All connectors shall have an insulated throat.
  3. For non-metallic conduits, fittings shall be PVC Schedule 40 type. Use PVC schedule 40 adapters at all boxes and panelboards..
  4. Brush or dauber apply PVC cement.
  5. All PVC components, (conduits, fittings and cement) shall be of same manufacturer.
  6. For flexible metallic conduits, fittings shall be zinc plated steel/malleable iron squeeze type.
  7. For liquidtight flexible metallic conduits, fittings shall be zinc plated steel/malleable iron compression type.
  8. Use of the following is prohibited:
    - a. Crimp-on, tap-on or indenter type fittings.
    - b. Spray (aerosol) PVC cement.

## 2.9 PULL BOXES

- A. Pull Boxes shall meet all code requirements as to size for conduits terminating therein and to thickness of material used in fabrication.
- B. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. Box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.
- C. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.
- D. Approved manufacturers for metal boxes are Cooper B-Line, Milbank, Hoffman or approved equal.

- E. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be manufactured by Christy Concrete Products or approved equal. All pull boxes shall be H/20 rated and be equipped with H/20 rated galvanized steel checker plate cover marked "Electric, Lighting, Fire Alarm or Signal.

#### 2.10 TIME SWITCHES

- A. Time switch shall be a two circuit digital time clock with photocontrol input, battery back-up and a surface enclosure. Provide a flush enclosure when indicated. Tork #DGLC (120V) or DGLC-3 (277V) or approved equal.

#### 2.11 OUTLET BOXES

- A. All outlet boxes shall be standard one or two piece galvanized knockout outlet boxes. Raco, Appleton, Thomas and Betts or approved equal.
- B. All outlet box covers, rings or other fittings shall be standard galvanized. Raco, Appleton, Thomas and Betts or approved equal.
- C. No outlet box shall be smaller than four inches (4") square and 1 ½" in depth, except in concrete block construction where Raco, Appleton, Thomas and Betts concrete masonry boxes are approved.
- D. Floor outlets on grade shall be fully adjustable type floor boxes, suitable for use in concrete floors. Wiremold #RFB6E-OG with Wiremold #8CTCNK Evolution cover assembly. Where floor box is installed in a bare concrete floor, provide a Bare Concrete and Terrazzo ring, Wiremold #RFB6E-CTR. Cover shall be die-cast aluminum with nickel finish, unless otherwise noted on drawings. For 120V power, provide a specification grade 20A 125V duplex receptacle with internal duplex receptacle bracket #RFB6DP, quantity and type as shown on drawings. For data/telephone, provide a decorator style receptacle opening bracket #RFB6GFI for a mounting frame to accept the modular telephone/data jacks, unless noted otherwise on drawings. Any unused device compartments shall be covered with internal blank bracket #RFB6B.
- E. All special outlets shall be as hereinafter specified or as shown on drawings.
- F. Thru boxes are not permitted.
- G. Any unused boxes shall be equipped with a blank cover plate.

#### 2.12 RECEPTACLES

- A. Furnish and install an industrial specification grade 20A, 125 volt, 3 wire grounding type duplex receptacle with one piece brass mounting strap at all receptacle outlets as indicated on drawings. Leviton #5362-I or equal as manufactured by Hubbell, Pass and Seymour, Cooper or other approved manufacturers.
- B. Device color to be ivory.
- C. Isolated ground receptacles shall also provide TVSS (Transient Voltage Surge Suppression) as follows: Surge protection 320 Joules hot-neutral, ground-neutral, hot-ground, RFI and EMI noise filtration of 7:1 reduction. A LED shall indicate surge protection unit is in operation. Receptacle shall be 20A, 125V NEMA 5-20R, Leviton #8380-IG-O or approved equal.

- D. G.F.C.I. duplex receptacles shall be provided for 15 and 20 amp 125 volt circuits where required by the C.E.C. #210.8 and #590.6. At indoor locations provide a Leviton #G5362-00W or equal. At exterior locations, provide weather-resistant type G.F.C.I. duplex receptacles, Leviton #G5362-WTW or equal. At damp locations, provide a diecast weatherproof lockable cover, RACO #5028-0 or equal. At wet locations, provide a diecast weatherproof “while-in- use” lockable cover. Red Dot #CKSUV or equal.

*[Designer’s Note: Be sure to use the following for pre-schools and/or elementary schools]*

## 2.12 RECEPTACLES

- A. Furnish and install an industrial specification grade 20A, 125 volt, 3 wire grounding type tamper-resistant duplex receptacle with one piece brass mounting strap at all receptacle outlets as indicated on drawings. Leviton #5362-SGW or equal as manufactured by Hubbell, Pass and Seymour, Eaton or other approved manufacturers.
- B. Device color shall be white.
- C. Tamper-resistant isolated ground duplex receptacles shall be 20A, 125V NEMA 5-20R, orange in color. Leviton #T5362-IG or approved equal.
- D. Tamper-resistant G.F.C.I. duplex receptacles shall be provided for 15 and 20amp 125 volt circuits where required by the C.E.C. #210.8 and #590.6. At indoor locations, provide Leviton #G5362-0TW or equal. At exterior locations, provide weather and tamper-resistant type G.F.C.I. duplex receptacles, Leviton #G5362-WTW or equal. At damp locations, provide a diecast weatherproof lockable cover, RACO # 5028-0 or equal. At wet locations, provide a diecast weatherproof “while-in-use” lockable cover, Red Dot #CKSUV or equal.

## 2.13 LOCAL SWITCHES

- A. Furnish and install industrial specification grade, quiet type toggle switches, 20 AMP rated 120/277V AC only, controlling wall and ceiling outlets as indicated on the drawings. Leviton #1221-2I or equal as manufactured by Hubbell, Pass and Seymour, Cooper or other approved manufacturers.
- B. Where two or more switches are in proximity they shall be ganged in the same box and they will be set under one plate. Switches controlling lights and/or outlets on emergency power shall be kept entirely independent of all other switches not on emergency power by mounting in a separate box.
- C. Special receptacles or switches shall be as noted on drawings.
- D. Where key switches are noted on the drawings, provide Leviton #1221-2KL.
- E. Device color to be ivory.
- F. When a switch is used as a disconnecting means, it shall be mounted in a readily accessible location.

## 2.14 WALL PLATES

- A. All wall plates for electrical outlets and devices shall be smooth stainless steel, non-magnetic type 302S.

- B. All telephone outlet plates shall be blanked plates.

## 2.15 CONDUCTORS (Wire)

- A. All wire installed in this contract shall be of a standard manufacturer as approved by the National Board of Fire Underwriters and be of the size as indicated on the drawings. All wire shall bear the Underwriters' label and shall be brought to the job in unbroken packages and approved by the Job Inspector before it is installed.
- B. All power conductors, #10 AWG and smaller shall be type THWN copper, unless otherwise noted. All conductors #8 AWG and larger shall be type THWN-2 copper, unless otherwise noted.
- C. All underground 480/277 volt power conductors shall be type XHHW copper, unless otherwise noted.
- D. Number 12 AWG wire shall be the smallest gauge wire used, except for signal circuits, which shall be as shown on plans or as specified under other sections of these specifications.
- E. All wire #8 AWG gauge or larger shall be stranded.
- F. The neutral conductor of all lighting feeders shall be of the same size as the phase conductors.
- G. Splices on all wire less than #8 gauge shall be with insulated spring connectors Ideal "Wing Nuts", 3M "Scotchlok", or equal.
- H. Splices in wires #8 gauge and larger shall be made with crimp on solderless connector, 3M Scotch, Burndy or equal. Connectors to switches or bus bar shall be made with one piece lugs for all wires, sized for conductors as shown on plans.
- I. Each branch circuit shall be marked with the circuit number at the panel and at the first outlet nearest the panel. E-Z Code Markers (Thomas and Betts) or equal shall be used to label the circuits.

## 2.17 LIGHTING FIXTURES

- A. This Contractor shall submit for approval seven (7) portfolios with full description and manufacturer data sheets of all fixtures (including ballasts and lamps), that he proposes to use.
- B. This Contractor shall furnish and install all lighting fixtures and lamps as indicated on the Electrical Drawings and in accordance with these specifications.
- C. This Contractor shall be held responsible for the complete equipment of all fixture outlets with fixtures of the proper design as shown.
- D. All fixtures shall be securely anchored to prevent any possible chance of their falling.
- E. Continuous runs of fixtures shall be installed straight and true.
- F. Recessed fixtures shall be complete with plaster frames, supporting brackets and hanger wires.
- G. Stem lengths shall be adjusted to meet conditions where required. Furnish aligners to ensure vertical alignment (ball aligner).
- H. Electrical Contractor shall coordinate outlets with Acoustic Tile contractor and other trades and locate outlets in center or at intersections of acoustical tile in all acoustical tile ceilings.

- L. Recessed fixtures in T-bar ceilings shall be attached to T-bar with integral t-bar clips, two at each end of each fixture.
- M. When the light fixture is equipped with an integral emergency battery pack, the light fixture shall be connected so that it is controlled via the room light switch and is automatically energized when power has fails.

#### 2.19 PHOTO CONTROL

- A. Paragon or equal, adjustable type.

#### 2.20 MOTOR DISCONNECTS

- A. Disconnects shall be fused safety switches with dual element fuses. Heavy Duty rated with quick-make, quick-break operating mechanism. Fuse rating shall comply with motor manufacturer's recommendations. Switch shall be UL listed. Disconnects shall have an external operating handle, lockable in the open or closed position.
- B. Disconnect switches shall be located so as not to obscure any part of the HVAC unit's nameplate data.
- C. Each disconnect switch shall have an engraved Bakelite nameplate identifying the panel and circuit number that feeds the motor. Nameplates shall comply with specifications for "Identification of Switches and Apparatus".

#### 2.21 DRY TYPE TRANSFORMERS

- A. Transformer shall be Class H insulation with temperature rise not exceeding 115 degrees C., in a maximum ambient of 40 degrees C., with rated nameplate load connected to the secondary side, at rated voltage. Unless otherwise noted, the transformer shall comply with the Energy Efficiency levels mandated by the Department of Energy.
- B. Transformer shall be built in accordance with the latest revised IEEE, ANSI and NEMA standards.
- C. Case temperature shall not exceed 35 degrees C., above ambient.
- D. Designs shall incorporate built-in vibration dampening systems.
- E. Terminal compartment shall be located to insure termination of cable leads in temperature levels not to exceed 60 degrees C., and to provide for side or bottom entrance of conduit. Enclosures shall be weatherproof and rodent proof. Ventilation openings shall be louvered type. Screening will not be acceptable.
- F. Transformer shall be furnished with 2 taps above and below rated voltage, each 2 ½%.
- G. Transformer shall be suitable for non-linear loads and have a U.L. rating of K-4.
- H. Acceptable manufacturers shall be Square "D", General Electric, Eaton, Siemens or approved equal.

#### 2.22 TELEPHONE CABLES

- A. When telephone cables are indicated on drawings, they shall be Category 3, 24 AWG, unshielded twisted pairs with 4 pairs minimum, AVAYA #1010 or equal. If in a plenum, use plenum rated cable, AVAYA #2010 or equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. CONDUIT SYSTEMS

1. A concealed conduit system shall be installed for all interior wiring including controls. Conduit shall be run continuous between outlets, etc., and with the minimum number of bends.
2. PVC 40, galvanized rigid steel wrapped with PVC tape or galvanized rigid steel with factory applied PVC coating shall be used for underground runs.
3. Where underground conduit cannot be run below building footings and the Contractor shall provide PVC-80 sleeves through the footings (Contractor shall obtain approval for all sleeve sizes and locations with the Structural Engineer before installation).
4. All conduit shall be delivered to the site of construction in their original bundles. Each length of conduit shall bear the label of the National Board of Fire Underwriters. All conduit subjected to rough usage while on the job before installation and not acceptable to the Architect shall be removed from the premises upon notice.
5. Conduit installed in masonry walls shall be rigid steel galvanized conduit, PVC or EMT, not in same cell as re-bars.
6. The joints in all conduits installed under concrete slabs on the ground, or underground, or exposed to the weather, shall be made liquid and gas-tight. All underground conduit outside of the buildings shall be buried to a depth of not less than 24" below finish grade. Utility services shall comply with utility company requirements. Two or more conduit runs installed in a common trench shall be separated horizontally by at least four inches (4"). Electrical conduit runs installed in a common trench with other utility lines shall be separated horizontally from such lines by at least twelve inches (12").
7. Changes in direction shall be made with conduit sweep elbows or long radius bends made on the job. Where two or more conduits are grouped in exposed locations, the sweeps shall be struck from the same center forming concentric arcs.
8. All joints in conduit shall be made with standard coupling. In making joints, conduits must be truly and accurately cut and threaded (where applicable) with straight thread, smoothly reamed and squarely butted. All conduit shall be kept corded and dry during construction, using plastic caps or conduit pennies held in place with conduit bushings. Should dirt or moisture collect in any conduit, the Contractor shall swab them out to the satisfaction of the Architect.
9. Conduits ending at the motors shall be carried as close as possible to the terminal blocks making allowance for the movement of the motors when they are equipped with slide rails. The connection between the conduit terminals on the motor and the conduit shall be made with liquid-tight flexible conduit using the proper fittings.
10. All conduits where they enter panel enclosures, pull boxes, or outlet boxes shall be secured in place by galvanized locknut inside of box.
11. Where conduits are run exposed, they shall be installed straight and true with reference to the adjacent construction.
12. Any conduit installed under building shall be under the slab. The top of any conduit below floor slab shall be a minimum of 4" below the bottom of the concrete slab.
13. All boxes for bracket outlets shall be equipped with a 3/8" "No-Bolt" fixture stud. These boxes shall be so set that when in place the fixture shall be at right angles to the ceiling or walls.
14. All empty conduit shall be equipped with a nylon pull rope continuous from outlet-to-outlet or end-to-end.
15. Flexible conduit will be permitted for connecting lighting fixtures to junction boxes.

16. Flexible connections in outdoor and damp locations shall be flexible liquid-tight metal conduit or non-corrosive seamless metallic tubing with watertight connections.
17. Install roof jacks for this construction in accordance with other sections of this Specification.
18. The maximum allowed length of flex conduit at equipment connections is 18”.
19. Expansion joints for conduit shall be provided where required to compensate for thermal expansion and contraction.
20. At all sub-panels and terminal cabinets, stub two 1”C and two ¾”C into the accessible attic space. If the attic space is not accessible, stub conduits to a location as directed by Architect or Engineer.
21. Support conduits on roof with pre-fabricated pipe supports (B-Line “C-Port Series” or equal), spaced 8 ft. O.C. maximum. Minimum clearance from roof to framing channel shall be 4”. Framing channel length shall be as required plus 50% spare length. Installation shall comply with manufacturer’s recommendations.
22. Any conduit entering underground pull boxes shall be sealed to prohibit water from entering the conduit. Conduits with conductors shall be sealed with a sealing compound after all conductors have been installed. All spare (empty) conduits shall be identified with either the “origination” or “destination” (example: to pull box 150’ to the south, from Main Switchboard, etc.). The contractor shall use a scrap piece of ¾” PVC conduit, approximately 5” in length and tie the nylon pull string thru it. Write the description on the conduit using a indelible/permanent marker.

#### B. OUTLETS

1. In general, the locations of electrical outlets shall be as shown on the drawings; however, the Contractor shall make any changes necessary to suit conditions on the job or rearrangement of built-in fixtures and equipment as directed by the Architect or his representative.
2. The Contractor shall study the general building plans with relation to spaces surrounding each outlet in order that his work may fit the work of others and that when fixtures or other equipment are installed they will be symmetrically located according to room layout. Refer all conflicts and discrepancies promptly to the Architect.

#### C. OUTLET BOXES

1. Outlets for concealed wiring shall be flush with the finished wall or ceiling surfaces. Pull boxes, junction boxes and all others to which no fixture or device is to be attached, shall be fitted with blank cover plates and painted to match surroundings. In order to reduce noise transmission between rooms, outlet boxes shall not be installed back to back. Where outlets are side by side and faced into opposite rooms, the boxes shall be at least 6” apart, except in fire rated walls space boxes at least 24” apart. If the boxes are connected together, the connection shall be flexible and shall have openings packed with fiberglass.
2. The Electrical Contractor shall inform himself of wall thickness throughout the building and shall provide outlet boxes of suitable depth that can be flush mounted and yet will be deep enough to contain the particular apparatus involved. Location of exposed pull or junction boxes will be subject to the Architect’s approval.
3. Outlets from which lights are suspended shall have approved 3/8” fixture studs fastened through from back of box. All outlet boxes and particularly those supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. All lighting fixture outlets shall be coordinated with mechanical, architectural, or other equipment to eliminate conflicts and provide a workable, neat installation.

4. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate; provide box partitions as required by the C.E.C. Switches controlling lights and/or outlets on emergency power shall be kept entirely independent of all other switches not on emergency power by mounting in a separate box.
5. Outlet box extensions shall be UL listed and shall be attached to box with threaded metal screws, Bridgeport "REX" series or equal. "Flash guards" are not permitted to be used as box extensions.

#### D. LOCATIONS OF OUTLETS

1. The Architect reserves the right to make reasonable changes in the indicated locations before work is roughed in without additional charge to the Owner.
2. Where wainscot occurs at the 4'-6" level, the switch shall be mounted lower in the wainscot as near the 4'-0" level as possible, but in no case, shall the switch be partially in the wainscot and partially in the wall. It shall be the Electrical Contractor's responsibility to verify all door swings. Switches, unless specifically noted, shall be on the strike side of the door. If switch is indicated on hinged side of door, verify location with Architect.

#### E. CONDUCTOR IDENTIFICATION AND INSTALLATION

1. The drawings indicate the arrangement of outlets on each branch circuit and the circuit tags show the number of the circuit, and the board to which it will be connected. Circuits indicated with the same numbers shall be connected to the same breaker on the panelboard.
2. All feeders and branch circuits shall be tagged in all pull boxes and in the gutters of all panels to which they connect.
3. All wiring shall be done in identified neutrals.
4. No wire shall be installed until all work of other contractors that might cause injury to the said wire has been completed. Care shall be used to pull wires to insure that no damage occurs to the insulation. A wire lubricant shall be used for pulling in wires.
5. In making the connection of all branch circuits to the terminals of switches, base plugs, etc., the wires shall be looped around the binding screws or be fitted with connecting lugs. At the ceiling outlets, this Contractor shall leave not less than 6" of free ends on each wire for connections to the fixtures.
6. No splices shall be permitted except in outlet boxes, and in panelboard gutters.
7. Switches and receptacles shall be securely fastened to the outlet box. Where the outlet box covers are back of the finished walls the switch or receptacle shall be built out from the same with washers so that it is rigidly held in place to the box. The floating of any switch or receptacle will not be permitted.
8. All signal and communications conductors shall be identified in terminal cabinets as to type of system e.g.: clock, bell, fire alarm, etc. and location of other end of conductor by room number or name as directed by owner. Identification shall be by numbers at terminal strips and a numbered directory in cardholder inside terminal cabinet.

*[Designer's Note: Be sure to specify addressable cable in fire alarm specifications if needed]*

9. Fire alarm system wiring shall be color-coded as follows:

Initiating Devices: Two Yellow wires,  
Two Orange wires (except where addressable cables are  
used. Signaling Devices: Two Black wires,  
Two Red wires

10. All power wiring size #6 AWG and smaller, shall be factory color-coded. For larger than #6, mark conductors on each end and at all junction and/or pull boxes with a 1” band of colored pressure-sensitive plastic tape. For isolated ground wires, mark with a 1” band of green tape, followed by a 1” band of yellow tape, followed by a 1” band of green tape. Colors for each phase and the neutral shall be consistent throughout the system. Color code shall be as follows:

WIRE	120/208V	480/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Equip. Ground	Green	Green
Iso-Ground	Green w/Yellow stripe	

The white or gray conductor shall be the neutral at each outlet. All switches shall be installed in “hot” leg. On all lighting circuits the switch leg shall be purple from switch to fixture. All travelers from switch to switch on 3 and 4-way switches shall be pink.

This color code shall be followed by contractor for all fixture whips except for factory-manufactured whips. When factory manufactured whips are used, color code shall apply to all wiring except the factory whip.

11. Conductors having white, gray or green covering shall not be used to indicate other than neutral or grounding. This limitation applies to all power, lighting, and control circuits.
12. Installation of conductors shall be made in a neat and workmanlike manner to meet Code requirements and shall be run continuous without weld, splice or joint between boxes. Do not install wires in conduit unless the entire system of conduit and outlet boxes is permanently in place. All conductors shall be pulled using a UL approved wire lubricant.
13. Make all terminations at motors using 3M Series 5300 Motor Lead/Cable Splicing Kits. Make connections per 3M written installation procedures.
14. On all bolted electrical connections, the contractor shall use Belleville washers.
15. All wiring to be neatly bundled and tied with nylon cord or plastic straps.
16. When approved by the Electrical Engineer, splices in underground pull boxes shall be made with crimp on compression connectors and insulated with heat shrink sleeves or with splice kits listed by the manufacturer for wet locations. Wire nuts are not permitted. Cables and/or conductors for fire alarm and signals systems shall not be spliced.

#### F. GROUNDING

1. The conduit system supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded, accordance with Title 24 of the California Code of Regulations. The neutral shall only be grounded at the main service location unless specifically noted otherwise on the drawings or required by the California Electrical Code.
2. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc.: where it is not possible to obtain good contacts, the conduits shall be bonded around the boxes with a #6 AWG conductor with ground clamps.

3. All equipment cases, motor frames, etc. shall be completely grounded to satisfy applicable code requirements.
4. At each building, the interior hot and cold water piping and the interior aboveground gas piping shall be bonded to the building service equipment per C.E.C. #250.104.
5. Do not use underground gas piping as a grounding electrode.
6. Pull a green equipment ground conductor in all power conduits, both metallic and non-metallic.
7. Pull a separate isolated ground wire to isolated ground receptacles, insulated green with yellow stripe, in addition to the equipment ground conductor.
8. Isolated ground conductor shall begin at the isolated ground bus in the panel in the building served and shall not be connected to any neutral conductor or any item not isolated from the system ground. All isolated ground circuits shall have a separate neutral conductor (not used for more than one circuit). The isolated ground conductor cannot extend upstream from the building served.
9. Each disconnect switch shall have a ground connector (lay in wire type) which shall be used for grounding the disconnect enclosure. The ground wire shall continue and be connected to the enclosure of the equipment served.
10. Where there is more than one building supplied from a common service, provide a grounding electrode at each building per C.E.C. #250.32.
11. At each telephone backboard and/or data backboard, provide a power distribution block (one pole with two primary openings and six secondary openings) and mount at + 18" A.F.F. unless otherwise noted. Run ¾"C - 1 #6 AWG to the ground bar of the nearest panel or the ground bus of the main switchboard. Power distribution block shall be Square D #LBA 163206 or equal.

#### G. MOUNTING HEIGHTS OF EQUIPMENT

1. Unless otherwise specified elsewhere or shown on the plans, the following mounting shall apply:

Panelboards:	6'-0" top of box
Disconnect Switches:	4'-0" to center line
Contactors:	4'-0" to center line

#### H. IDENTIFICATION OF SWITCHES AND APPARATUS

1. All switchboard circuits, externally operated switches and apparatus used for the operation of or control of circuits, appliances, or equipment shall be properly identified with an engraved bakelite nameplate, 1" x 3", black letters on white background. All such nameplates shall be of the self-adhesive type and attached onto the apparatus by screws or rivets. Card holders in any form are not acceptable.

#### I. EARTHQUAKE PROOFING OF LIGHT FIXTURES

1. Fixtures weighing more than 50 pounds shall be supported independently of the outlet box.
2. Pendant type fixtures shall be designed so that they may swing horizontally in any direction a minimum of 45 degrees from the vertical. Pendant shall have ball aligner at top, and swivel connection at fixture. If there is an obstruction within the 45 swing of the fixture the contractor shall provide a State approved restraint to keep fixture from swinging into the obstruction.
3. All fixtures mounted in or on suspended ceilings shall be fastened to the ceiling-framing members in accordance with C.E.C. #410-36(B.. Recessed fixtures in t-bar ceilings shall be attached to t-bar ceiling with integral t-bar clips, two at each end of fixture.

4. Recessed fixtures in T-bar ceilings shall be attached to the building structure above, as follows: If T-bar grid is heavy duty rated, use #12 Ga. slack safety wire at each of two diagonal corners of each fixture (two wires per fixture).

#### J. FIRE RATED AREAS

1. Where light fixtures, conduit, cabinets, or boxes penetrate fire rated ceilings, walls or floors provide a fire rated enclosure or fire stop. Rating of enclosure or fire stop shall match or exceed rating of area penetrated. Verify location of fire rated areas with architectural drawings and with General Contractor.
2. Where outlet boxes are recessed on opposite sides of a fire rated wall, boxes shall be separated by a horizontal distance of at least 24 inches. Where the wall opening for a steel electrical outlet box exceeds 16 sq. inches in area, or an aggregate of more than 100 sq. inches for any 100 sq. feet of wall or partition area, fire stopping is required.
3. Penetrations in walls, floors or ceilings requiring protected openings shall be fire-stopped. Fire-stopping shall be of an approved material, securely installed and be in conformance with the 2019 C.B.C., Chapter 7.

### 3.2 COORDINATION

#### A. HEATING, AIR CONDITIONING, PLUMBING AND OTHER MECHANICAL WORK:

1. The Mechanical Contractor shall furnish equipment such as motors, starters, thermostats, wiring diagrams, etc. However, the Electrical Contractor shall be responsible for furnishing and installing of all fused disconnect switches, conduits, wire, fittings, etc. for power connections.
2. Install all electrical equipment where it is not already installed as a part of a unit furnished by the equipment Contractor. (See drawings of respective contractors).
3. The Electrical Contractor shall furnish fused disconnect switches for pumps, motors and air conditioning and handling units, if they are not furnished by others. Fuses shall be dual element, rating per equipment manufacturer's recommendations. Disconnects shall comply with requirements for "Motor Disconnects" as specified earlier in this section.
4. All disconnect switches (whether provided with unit or by contractor) shall have a circuit identification engraved nameplate as specified under "Motor Disconnects".
5. Thermal overload protection shall be furnished for all motors where such protection is not included as a part of another contract.
6. All motor outlets, disconnect switch locations and control outlets shown on the plans are approximate only. Verify exact location of same with Equipment Contractor.
7. All line and low voltage controls, including conduits, outlets, wiring and connections shall be furnished and installed by the Mechanical Contractor. (Div. 23).
8. Furnish and install a weatherproof duplex receptacle with ground fault circuit interrupter protection within 25 ft. of all rooftop H.V.A.C. units. Provide diecast weatherproof "while-in-use" lockable cover, Red Dot #CKSUV or equal.
9. Coordinate with general contractors, mechanical contractors and equipment suppliers before bid is submitted and again before rough-in is started to verify that all systems are complete and all components are provided including starters, disconnects, relays, solenoids, control conduit and wire, etc.

### 3.3 MISCELLANEOUS:

#### A. MISCELLANEOUS EQUIPMENT

1. Contractor shall be responsible for electrical hook up and connections to all electrical equipment whether furnished by this Contractor or others, including wiring, conduit, disconnects, circuit breakers etc., even if not shown on drawings. Verify all locations and requirements with equipment supplier before rough-in.
2. When there are fire sprinklers, the electrical contractor shall connect bell, flow and tamper switches and other electrical devices as required by sprinkler contractor and local and state fire marshal. Verify requirements with general contractor before bid.

#### B. INTERRUPTION OF SERVICE

1. Interruption of service in existing buildings shall not be made at a time which will inconvenience the Owner. Before making any final connections to the existing buildings or doing any other work that will interrupt the service, the Contractor shall consult with the Owner and schedule the work at Owner's convenience even if it is necessary to make such connections after regular working hours.
2. This Contractor shall do all rerouting and reconnecting of existing electrical facilities made necessary by this construction. Care shall be taken not to disrupt existing facilities. If any facilities are disrupted, this Contractor shall replace or repair them at his expense and to the satisfaction of the Architect.

#### C. CHANGES

1. Electrical Contractor shall consider the number of outlets for electric equipment shown on plans as final, but the Architect reserves the right to shift same, within reason, to a location and position which will meet more completely final requirements.

#### D. GUARANTEE AND TESTS

1. All electrical equipment testing and related costs shall be included in the contractor's bid.
2. Contractor shall obtain approval from the architect of proposed independent testing agencies before any testing is started.
3. Equipment of all kinds installed by this Contractor shall be tested to determine whether it fulfills the requirements of these specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.
4. Should any piece of apparatus or any material or work fail in any of these tests, it shall be immediately removed and be replaced with new material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.
5. All circuit breakers, 100 amps or more, shall be tested by an independent testing agency in accordance with NETA specifications and a report submitted to the Architect. Any circuit breaker that does not pass the test shall be replaced.
6. The entire installation shall be free from short circuits and improper grounds. Panels and circuits shall be tested for grounds and shorts. Each individual circuit shall be tested at the panel with the equipment connected for proper operation. Ground tests shall meet the requirements of the California Electrical Code. Upon completion of the work, a final inspection by the Architect and other interested authorities shall be conducted. This Contractor shall guarantee to repair or replace at his expense any material or equipment that develops defects or is determined not to be in conformance with the plans and specifications, during a period of one year after work is accepted by the Owner.

7. The grounding electrode system at the main electrical service equipment shall be tested by an independent testing agency in accordance with the three point fall of potential method as specified in IEEE Standard 81-1983. Maximum ground resistance shall be 25 OHMS. A copy of the test report shall be submitted to the architect and engineer of record.
8. The independent testing agency performing the above mentioned tests shall be NETA or NICET certified or approved by the electrical engineer.

E. GROUND FAULT SYSTEMS TEST PROCEDURE (TESTS REQUIRED FOR 480V MAIN DISCONNECT)

1. Visual and Mechanical Inspection:

- a. Inspect for physical damage and compliance with plans and specifications.
- b. Inspect neutral main bonding connection to assure:
  - i. Zero sequence sensing system is grounded.
  - ii. Ground strap sensing systems are grounded through sensing device.
  - iii. Ground connection is made ahead of neutral disconnect link on zero sequence sensing system.
  - iv. Grounded conductor (neutral) is solidly grounded.
- c. Inspect control power transformer to ensure adequate capacity for system.
- d. Monitor panels (if present) shall be manually operated for:
  - i. Trip test
  - ii. No trip test
  - iii. Non-automatic reset
- e. Proper operation and test sequence shall be recorded.
- f. Inspect zero sequence systems for symmetrical alignment of core balance transformers about all current carrying conductors.
- g. Verify ground fault device circuit nameplate identification by device operation.
- h. Set pickup and time delay settings in accordance with the project electrical engineer's provided settings.

2. Electrical Tests:

- a. Measure system neutral insulation resistance to ensure no shunt ground paths exist. Remove neutral-ground disconnect link. Measure neutral insulation resistance and replace link.
- b. Determine the relay pickup current by primary injection at the sensor and operate the circuit-interrupting device.
- c. Test the relay timing by injecting one hundred fifty percent (150%) and three hundred percent (300%) of pickup current, or as specified by manufacturer.
- d. Test the system operation at fifty-seven percent (57%) rated voltage.
- e. Test zone interlock systems by simultaneous sensor current injection and monitoring zone blocking function.

3. Test Parameters:

- a. System neutral insulation shall be a minimum of one hundred (100) ohms
- b. Relay pickup current shall be set to a value between 20% and 25% the rating of the main circuit breaker. The setting shall be the in-service setting unless otherwise specified.

- c. Relay time delay shall be the closest possible calibrated setting to .1 seconds. This shall be the in-service setting unless otherwise specified.

F. DEMOLITION

1. Remove and/or relocate electrical facilities as required to clear areas for new construction.

G. UTILITY COMPANY SERVICE CHARGES

1. All service charges shall be paid by the owner. Monthly energy charges shall be paid by the Electrical Contractor.

END OF SECTION 267000

## SECTION 28 31 00 FIRE DETECTION AND ALARM SYSTEM

### PART 1.0 - GENERAL

#### 1.1. DESCRIPTION

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled intelligent network fire alarm systems components required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification and/or the AHJ. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. The fire alarm system shall be manufactured by Hochiki America Corporation.
- D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm systems and the installation shall be in compliance with the UL 864 9th Edition listing.
- E. The project management and installation team shall be factory-trained by Hochiki America. Factory-trained technicians shall be on-site to guide project installation, programming and testing, and to prepare the system for inspection and turn-over to the owner.

#### 1.2. SCOPE

- A. General
  - 1. Connect to existing intelligent reporting, microprocessor controlled fire detection system with new components.
  - 2. Provide all programming necessary for operation of system in accordance to the project specifications and drawings.
- B. Basic Performance
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be employed on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
  - 2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
  - 3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit or as a direct panel NAC output.
  - 4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- C. Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

  - 1. The system alarm LED on the system display shall flash.

2. A local panel buzzer in the control panel shall sound with a distinct sound separate from the trouble indication sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated with each new fire alarm control panel event, along with time and date of occurrence.
5. All system output programs assigned via CAUSE AND EFFECT interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

### 1.3. SUBMITTALS

#### A. General

1. Electronic copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturers part numbers and other pertinent information herein is intended to establish the standards of performance, function and quality of the Hochiki FireNET UL-listed system and equipment. Equipment from other manufacturers may be not be substituted for the specified equipment.

#### B. Shop Drawings

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, battery calculations, equipment layout, device arrangement, complete wiring point-to-point diagrams, riser diagrams, conduit layouts, and sequence of operations.
3. Show system layout, configurations, and terminations.

#### C. Manuals

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

#### D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for all system points. The system structure and software shall place no limit on the type or extent of software modifications on-site.

E. Certifications

Together with the shop drawing submittal, submit a letter of certification from Hochiki America indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized Hochiki representative. Include names and addresses in the certification.

F. NICET Certification

1. Shop Drawings shall be prepared by NICET certified fire alarm technicians (Level III minimum).
2. Installation of all equipment shall be supervised by NICET certified fire alarm technicians (Level II minimum).

1.4. GUARANTEE

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid. A (4) year additional service/maintenance contract shall be quoted separately per section 1.5 POST CONTRACT MAINTENANCE of this document.

1.5. POST CONTRACT MAINTENANCE

- A. Complete maintenance and repair service for the fire alarm system shall be available from the Hochiki trained authorized FireNET representative for this project for a period of four (4) years after expiration of the guarantee per item B below.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all Testing, Maintenance, Inspection and Repair described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of four (4) years after expiration of the guarantee.
- C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ and/or local fire codes and regulations. A preventive maintenance schedule shall be provided by the contractor describing the procedures for preventive maintenance. The schedule shall include:
  1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water-flow switches and all accessories of the fire alarm system.
  2. Each circuit in the fire alarm system shall be tested semiannually.
  3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72.

1.6. POST CONTRACT EXPANSIONS

- A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

## 1.7. APPLICABLE CODES AND STANDARDS

The codes and standards below form a part of this specification. The system shall fully comply with the current or latest editions of these codes and standards as applicable.

### A. National Fire Protection Association (NFPA) - USA:

No. 13	Sprinkler Systems
No. 72	National Fire Alarm Code
No. 70	National Electric Code - Article 760
No. 101	Life Safety Code

### B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems (9th Edition)
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 346	Water-flow Indicators for Fire Protective Signaling Systems
No. 1971	ADA Visual Notification Appliances
No. 1481	Power supplies for Fire Protective Signaling Systems

### C. California State Fire Marshall

### D. Local, Municipal, and State Building/Fire Codes.

### E. Requirements of the Authority Having Jurisdiction (AHJ).

## 1.8. APPROVALS AND LISTINGS

### A. The system shall have proper listing and/or approval from the following recognized agencies:

UL - Underwriters Laboratories Inc  
FM - Factory Mutual Inc.  
CSFM - California State Fire Marshall

### C. The fire alarm system shall meet the requirements of the UL 864 9th Edition standard (Control Units) for the following types of listed service:

Local commercial protected premise: Automatic, manual, water-flow, sprinkler supervisory, Auxiliary Service, Central Station Service (DACT), Remote Station Service (DACT), and Proprietary.

## PART 2.0 - PRODUCTS

### 2.1. EQUIPMENT AND MATERIAL, GENERAL

- A. All Hochiki equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code and appropriate UL listing categories identified in this document.
- B. All Hochiki equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

### 2.2. CONDUIT AND WIRE

#### A. Conduit

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- 2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
- 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back-boxes, except where conduit entry is specified by the FACP manufacturer.
- 6. Conduit shall be 3/4-inch (19.1 mm) minimum.

#### B. Wire

- 1. Wiring shall be in accordance with local, state and national codes (e.g., NFPA70-NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 16 AWG for Notification Appliance Circuits.
- 2. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a fire protective signaling system.
- 3. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
- 4. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.

5. Wiring used for the network communications shall be twisted shielded pair, minimum 20ga., sized as necessary to support the extended fire alarm network.
6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.
8. All fire alarm system wiring shall be new. If pre-existing wiring is present it may be used for SLC or NAC circuits, provided that it meets the minimum requirements of the manufacturer, local code requirements and the site location Authority Having Jurisdiction.

C. Terminal Boxes, Junction Boxes and Cabinets

1. All boxes and cabinets shall be UL listed for their intended use and purpose.
2. All terminal, junction boxes and cabinets not marked with the fire alarm manufacturers name shall have the box covers painted red, or shall be designated with "F/A" or "Fire Alarm" in bold permanent lettering.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water-flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe, proper building grounding point, or grounding rod to the designated ground point on the fire control equipment.

2.3. MAIN FIRE ALARM CONTROL PANEL (FireNET)

A. General

Main FACP or network node shall be a Hochiki FireNET Series fire alarm control panel (e.g. FN-2127, FN-2127N, FN-4127, FN-4127N, etc.) and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, annunciators, expansion accessories, and other system controlled devices. The main FACP, networked nodes, and related system options shall consist of one or more of the following Hochiki America primary FireNET product line identifiers:

FN-2127	Fire Alarm Control Panel (2 loop/non-network)
FN-2127-N	Fire Alarm Control Panel (2 loop/network)
FN-4127	Fire Alarm Control Panel (4 loop/non-network)
FN-4127-N	Fire Alarm Control Panel (4 loop/network)
FN-4127-NIC	Network Interface Card
FN-4127-SLC	(2) Loop Expander Card

## B. Operator Control

### 1. Panel Sounder Silence:

- a. Activation of the control Panel Sounder Silence button in response to new alarms and/or troubles shall silence the local panel sounder signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of the "More Alarms", or "More Events" buttons shall advance the LCD display to the next alarm or trouble condition.
- b. Depression of the Panel Sounder Silence button shall also silence all Remote Annunciator panel sounders if so programmed per network node configuration.

### 2. Alarm Silence Button:

Activation of the Alarm Silence button shall cause all silenceable alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this button shall be fully field programmable within the confines of all applicable standards. The FACP software shall include optional auto-silence timers. The fire alarm panel display will continue to illuminate the "Fire" LEDs, and the Panel Sounder Silence yellow LED will indicate steadily until the fire alarm panel is RESET and the conditions are clear. Should other types of alarm or trouble conditions be present, the system shall respond accordingly and the appropriate LEDs associated with this category of alarm or trouble will indicate until the panel has been restored to normal condition. Subsequent alarms, if any, will activate the alarm notification appliances and relays again.

### 3. Fire Drill Button:

The Fire Drill button shall activate all notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation. The drill function shall latch these circuits and devices "on" until the panel is silenced or reset. The two red "Fire" LEDs shall flash, the yellow "On Test" LED shall indicate steadily on the panel display and the LCD display shall display "Fire Drill". Pressing the Fire Drill or Reset button shall silence and reset all related circuits and devices.

### 4. ReSound Alarm Button:

Pressing the "ReSound Alarm" button on the front display, at any time after the FACP has been silenced, but not Reset, will re-activate the notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation back into the appropriate alarm condition.

### 5. System Reset Button:

Activation of the System Reset button shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, and annunciator displays to return to their normal condition. Addressable duct detector relays will also return to normal condition provided the auxiliary relays have been configured to interrupt power to the duct detectors.

### 6. Lamp Test:

The Lamp Test button shall activate all local system LEDs and illuminate each segment of the liquid crystal display (LCD) while the Lamp Test button is depressed.

7. Programmable Function:

The Programmable Function button shall be user programmable and shall activate any programmed action or output, or group of actions or outputs associated with programmed Cause and Effect software control to function with the operation of this button.

Associated LEDs or display codes will appear on the FACP display as needed to indicate the category of the programmed function. The programmable function button will only activate when the button is pressed during Level 2 password access or when the front panel "Enable" key switch is on.

8. Enter:

The Enter button shall be used as necessary in association with the keypad to enter various commands, menus, or system modes.

9. Exit:

The Exit button shall be used to exit any level of access, various commands, menus, or system modes and return display to its original condition.

10. More Events:

The More Events button shall be used by the system operator to view additional alarm, trouble, supervisory or other event category conditions as they occur or have occurred on the FACP. The most current events shall be displayed first. Older events shall be displayed last. The system will automatically continue to organize and display events as they occur in real time. The events displayed in this menu are active and current events (current event buffer). For viewing historical events that have already been restored, the user must view the event history log.

11. More Fire Events:

The More Fire Events button shall be used to display all high priority "Fire" alarm conditions on the panel. The LCD display will display two fire alarm events at a time. The first (original) and last (latest) fire alarm events will be displayed by default. When the More Fire Events button is used, the system will cycle the last fire alarm event entry through all currently active fire alarm events, keeping the originating event concurrently displayed. The system will automatically continue to categorize and display alarm events as they occur in real time.

12. Numeric/Arrow Navigation Buttons:

The numeric arrow buttons shall be used by the system technician and/or other appropriate personnel to enter the Access Level 2 or 3 menu structures. From these menus personnel can perform programming functions, disablements, set system time, device parameters, printers, maintenance alerts, etc. The Access Level 2 menu functions are for standard user functions and system operation. The Access Level 3 menu functions are for system programming and higher-level administrator operations.

13.. Question Button (?):

The Question button shall be used by the system operator or technician to provide help to describe the particular menu or level the operator is currently in. For example, pressing the help button when the panel is in alarm mode will explain to the operator what is occurring and suggest appropriate action. Fire alarm systems that do not provide dynamic onboard front panel help via a menu function shall not be acceptable.

C. System Capacity and General Operation

1. The control panel or network node shall provide, or be capable of, SLC input/output capacity of 800 addresses and sub-addresses at full panel expansion.
2. The control panel or network node shall support (2) or (4) SLC loop configurations.
3. The control panel or network node shall support (127) sensors/detectors/modules and (127) addressable sounder bases per loop totaling up to 254 addressable points per SLC loop. Systems that are not capable of this SLC capacity shall not be acceptable.
4. The control panel or network node shall include five (5) onboard programmable Form-C relays with default operation for Common Fire 1, Common Fire 2, Common Trouble, Common Supervisory, and Auxiliary functions rated at a minimum of 1.0 amp @ 30VDC.
5. The control panel or network node shall include four (4) onboard Class B (NFPA Style Y) programmable Notification Appliance Circuits rated at 2.5 amps @ 24VDC.
6. The control panel or network node shall include three (3) onboard additional programmable supervised reverse polarity voltage outputs (common fire, common trouble, and programmable) rated at 500mA @ 24VDC.
7. Each FACP NAC, voltage, and relay output (except for Supervisory) may be individually programmed to operate on any pre-defined condition via Cause and Effect programming.
8. The control panel or network node shall include (500) network-wide zones. Systems that do not employ this type of zoning shall not be acceptable.
9. Protection: All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with the requirements of the UL864 9th edition standard.
10. Field Wiring Terminal Blocks: For ease of installation and service all panel I/O wiring terminal blocks shall have sufficient capacity for #18 to #12 AWG wire.
11. The control panel or network node shall include and employ (2) RS485 network ports configured in a Class A "ring" topology for high integrity operation. Systems that employ a single RS485 port or Class B 2-wire network operation shall not be acceptable.
12. The control panel or network node shall include a slave RS485 port for remote expansion accessories. This expansion port shall support up to (32) optional remote expansion accessories with a capacity of up to (512) secondary inputs and outputs or (15) local serial LCD annunciators and (17) expansion accessories. Systems that do not employ a slave RS485 port for expansion accessories shall not be acceptable.
13. The control panel or network node shall include (1) onboard RS232 port for PC programming.
14. The control panel or network node shall include (1) onboard RS232 port for 3rd party serial fire printer support.
15. The control panel or network node shall include (8) onboard digital logic inputs without the need for expansion modules. These inputs shall be capable of PLC style logic and secondary input operation. Systems that do not employ onboard digital inputs shall not be acceptable.
16. Protection: the control panel or network node shall incorporate surge and lightning protection devices as required to meet the UL 864 9th Edition criteria.

17. The system shall include a full featured operator interface control and annunciation panel that shall include a (320) character backlit (8 lines x 40 characters) Liquid Crystal Display (LCD), with individual color coded system status LEDs, and a keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
18. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The memory storage of the system shall be Flash memory type; EPROM type shall not be acceptable.
19. The system shall allow the programming of any input to activate any output or group of outputs via advanced Cause & Effect software programming. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or have only basic logic programming are not considered suitable substitutes.
20. The FACP shall support up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE" operators to be used for advanced programming. Logic statements shall require the use of a PC with Hochiki Loop Explorer software utility designed for programming. The logic statements shall support special macro operations to perform advanced automated system bypass disablements and multi-zone One Man Walk Test functions. Systems that do not employ this Cause & Effect capability, capacity, or special logic macros shall not be acceptable.
21. The FACP or network node shall include the following features:
  - a. Automatic drift compensation employed per UL864 9th Edition criteria where each smoke sensor/detector automatically adjust its zero-point, fire-point, and alarm threshold sensitivity to adjusted ambient environmental conditions ("clean-air" samples) taken within each (24) hour period. This operation adjusts each smoke sensor/detector automatically to suit ongoing subtle changes in the ambient air conditions. The adjusted values and operation ensure smoke sensors/detectors are always optimally tuned to their environment and do not fail to operate or false alarm as the smoke chambers slowly become dirty or obscured. Systems that do not employ automatic drift compensation to the UL864 9th Edition criteria shall not be acceptable.
  - b. Integral detector sensitivity test method between the control unit and the smoke sensor/detector that meets the requirements of NFPA 72 and UL 864 9th edition. Systems that do not employ integral detector sensitivity test method shall not be acceptable.
  - c. Early warning maintenance alert to warn of increasing dirt, dust, or other obscuration accumulation in the smoke sensor/detector chamber, or if the device drifts out of factory nominal ranges indicating a potential maintenance trouble condition. Systems that do not employ an early warning maintenance alert function shall not be acceptable.
  - d. Two individual variable sensitivity levels of alarm for each sensor/detector in the system, one for Day mode, and another for Night mode. The alarm level range shall be .88 to 3.57 of obscuration percent per foot for ALG-V analog/addressable photoelectric smoke sensors/detectors, and 0.5 to 3.8 for ALK-V analog/addressable photoelectric smoke sensors/detectors. Analog/addressable duct detectors shall have a range of 0.88 to 2.57 percent per foot. Analog/addressable ionization smoke detectors shall have sensitivity assigned according to fixed values set to low, medium, or high. Analog/addressable thermal heat sensors/detectors shall have an alarm level range of 32 - 158 degrees Fahrenheit, but are UL listed for fire when set between 135 - 150 degrees Fahrenheit.

- e. The system shall also include an automatic dynamic pre-alarm function assigned as a fixed relationship to the adjustable alarm threshold or sensitivity of a given sensor/detector. The dynamic pre-alarm value varies automatically with each sensor's/detector's sensitivity setting and is adjusted across the sensor/detector range. This allows for a continuously variable multi-step pre-alarm operation. Pre-alarm function can be turned on and off manually via programming option.
  - f. The ability to display or print system reports, loop/zone configurations, and history events.
  - g. Alarm verification of smoke sensor/detector zones per UL864 9th Edition criteria. Alarm verification time value shall be programmable from (5) to (60) seconds in (5) second intervals.
  - h. The ability to link inputs to outputs and/or to group inputs and outputs using Hochiki Loop Explorer Cause and Effect Wizard via simple point/click and menu driven programming. Systems that use DOS commands, machine language commands, executable statements, or #,+ -, or other non-standard unique programming styles are not acceptable.
  - i. Rapid alarm reporting with Hochiki DCP digital fire detection protocol supporting 1.5 second alarm response reporting worst case on any given SLC. All system nodes shall meet NFPA 72 requirements for alarm activation from initiation to notification within 10 seconds. Systems that do not meet this requirement and ability shall not be acceptable.
  - j. Automatic daily sensor/detector calibration and test function conducted by the control panel. This system shall automatically test and calibrate every sensor/detector in the system every (24) hours and perform drift compensation during each calibration event. Systems that do not employ automatic daily calibration and self test function shall not be acceptable.
  - k. Cross zoning (Coincidence operator) function: Any two objects of a subset applied in the "Cause" section of Cause & Effect using the "Coincidence" operator, will activate the output action subset outlined in the "Effect" section of Cause & Effect from any two objects defined in the "Cause" section of Cause & Effect. This function allows any two "Cause" input objects such as two detectors, two software zones, one detector and one software zone, one smoke detector and one thermal detector, or any combination of two inputs and/or zones to operate in a cross-zoned fashion via Hochiki Loop Explorer Cause and Effect Programming.
  - l. One Man Walk test mode with optional Cause & Effect driven macros for automated multi-zone One Man Walk Test mode operation.
  - m. Automatic day/night mode adjustment of sensor/detector sensitivities based on unique daily time schedules on a weekly basis.
  - n. Advanced auto-learn feature that learns all SLC loop devices and addresses, internal control panel and expansion structure, and network relationship to other nodes. The default learned configuration assumes safest UL864 and NFPA 72 compliant settings and attributes for all system components such that the system will not need further programming to operate in General Alarm mode. This allows the system to operate "out-of-the-box" after an auto-learn is performed. Systems that do not employ an advanced auto-learn function in this manner shall not be acceptable.
22. The FACP shall be capable of coding control panel notification appliance circuits in March Time, Temporal 3 (per NFPA 72/ANSI), and Continuous patterns for notification appliance devices.

- a. The network architecture shall be based on a communications package that utilizes a peer-to-peer, inherently regenerative highly secure format and protocol. A node may be an intelligent Fire Alarm Control Panel (FACP) or Network Remote Annunciator/Control Station (RNA). The network shall be capable of expansion to at least (64) panels and/or nodes.
- b. Each network node address shall be capable of storing up to (500) events. Any network node can serve as a reporting or control node for another node if necessary by programming the necessary network routing attributes.
- c. The network shall be capable of communicating via wire. A wire network shall include a fail-safe means of isolating the nodes in the unlikely event of complete power loss to a node. Loss of a network node, cable short-circuit, cable open-circuit, or fault of network communications shall activate a trouble signal on the network nodes (panels and network annunciators) programmed with the necessary network routing attributes. The wire network shall include and employ (2) RS485 network ports configured in a Class A "ring" topology for high integrity operation. The Class A "ring" topology network operation shall communicate in both directions over both ports and not be degraded by a single break anywhere on the network. The network wiring shall be a minimum (20) gauge twisted shielded pairs suitable for RS485 style communications. The network transmission shall be capable of (4000) feet between each node. The overall network wire length shall be capable of (256,000) feet in the maximum network configuration. Systems that employ a single RS485 port or Class B 2-wire network or that do not perform in the above manner shall not be acceptable.
- d. Network Fire alarm panels or nodes shall be capable of up to (500) software zones that may be assigned network-wide. Panels and network nodes shall not be restricted to unique zones. Any zone may be used by any combination of panels and network nodes. Systems that do not employ network-wide zoning or have zoning restrictions shall not be acceptable.
- e. Network process and event handling shall be capable of independently and separately routing each system event type and/or control from any network node to and from any other network node.

The network shall be capable of routing the following individual types of event categories:

1. Fire
2. Supervisory
3. Trouble
4. Pre-Alarm
5. Emergency
6. Auxiliary
7. Security
8. Disablements (Bypass events)
9. Test (Walk Test events)
10. Status & Control (system status/panel controls)

The network shall be capable of individually handling each of the above types of event categories as follows:

1. Process (act on the network event)
2. Display (display the network event)
3. Log (record the network event)
4. Print (print the network event)

5. Buzz (activate the buzzer from the network event)

Each network node (panel or network annunciator) shall be capable of having unique network routing assignments. Each network node shall be capable of receiving any and all network events from any and all other network nodes. Each network node shall be capable of receiving all events from a maximum size network of (64) nodes, which supports (51,200) addresses/sub-addresses within the (84,484) total system points possible. Systems that do not support these network capabilities shall not be acceptable.

D. Central Microprocessor

1. The microprocessor shall be state-of-the-art and shall communicate with, monitor and control all external interfaces. It shall include Flash memory for system program and site-specific configuration storage, and shall include a supervised "watch dog" circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all programs for specific actions to be taken if an alarm condition is detected by the system. Site-specific programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time/date annotation of system displays, printer, and history log. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real-time clock shall have an option for Daylight Savings Time. The real time clock shall also control panel functions such as Day/Night mode, Calibration, Alarm Verification, AC Failure Delay, Sounder Timeout, and I/O timer functions per their respective programmed settings.
4. The microprocessor shall utilize Hochiki FireNET DCP system protocol for efficient reliable communications with addressable analog addressable devices.
5. An auto-program (auto-learn) function shall be provided to quickly install initial default functions, SLC devices, and network attributes and make the system operational.
6. For flexibility and to ensure program validity, all system programs and functions shall be configured with the System Configuration Software Utility (Hochiki Loop Explorer software). This program shall be used to off-line program the system with batch upload/download functions, and shall have the ability to upgrade the manufacturer's (FLASH) operating system firmware code.

E. System Display and User Interface

1. The system shall support the following Liquid Crystal Display (LCD) properties:
  - a. Panel and annunciator displays shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of any other panel or network annunciator display if so programmed via network routing attributes.
  - b. The LCD display shall have a contrast adjustment to set to contrast intensity of the display.
  - c. The LCD display shall include a ¼" plexi-glass clear protector cover to prevent field damage and to provide security protection from vandalism.
  - d. The LCD display shall provide comprehensive information for system events, menus, and devices. At a minimum the following shall be displayed: date, time, node#, loop#, zone#, address#, sub-address#, device type, event category, specific event type, action message, and (40) character location text. Menu text shall display complete and unabbreviated verbiage. Systems that support less than (320) characters total, (8) lines total, (40) characters of location text, or employ abbreviated text shall not be acceptable.

2. The system shall provide indications and controls on the front panel or annunciator user interface as follows:
  - a. Control buttons: Panel Sounder Silence, Alarm Silence, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test.
  - b. Light-Emitting Diode (LED) indicators: AC Power On, (2)-Fire Alarm, Pre-Alarm, Fire Output Active, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, System Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications are not acceptable.
  - c. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons.
  - d. The system user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming.
  - e. The system shall support easy entry of password codes via navigation system or key switch to easily access level 2 or level 3 command menus.

F. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to (4) SLC loops. Each SLC loop shall provide power to and communicate with up to (127) analog addressable sensors/detectors (ionization, photoelectric, duct, and/or thermal) and addressable modules (input monitor, addressable pull-station, output relay, conventional zone, and/or supervised output), along with (127) addressable sounder bases for a loop capacity of up to (254) SLC devices. The (2) loop panel shall be capable of supporting (508) SLC devices and when the two-loop expander is used the (4) loop panel shall potentially be capable of (1016) devices by loop architecture, however the panel memory maximum will limit this total to (800) addresses and sub-addresses for the (4) loop panel.
2. SLC wiring shall support a wiring distance of up to 10,000 feet per circuit.
3. Individual FireNET panels can be networked up to (64) nodes to provide a maximum of (51,200) addresses/sub-addresses within the (84,480) total system points possible. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
4. FACP shall receive analog information from all analog addressable sensors/detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each sensor/detector. The software shall automatically maintain the sensor/detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each sensor/detector. The panel will assess the sensor/detector analog data to determine when the fire condition is reached and the alarm must be generated. The analog information shall also be used for automatic detector testing/calibration and for the automatic determination of detector maintenance requirements. See Drift Compensation and Calibration portions of this document for additional details.

5. Point monitor modules shall be programmable for one of (13) different types of event categories depending on the module type: fire, trouble, pre-alarm, supervisory, emergency, auxiliary, security, silence, reset, fire drill, transparent, disablement, or test mode. In addition, each point shall be capable of being assigned an action message. There shall be (20) action messages total (11 preset and 9 custom with up to 15 characters each). Each point shall have the capacity for up to (40) alphanumeric characters. In addition any monitor module can, via its selected program, individually override alarm output delays, set an input delay time, and support advanced programming options. NFPA, UL, AHJ, and local, state, and federal codes must be observed. Systems without this capability shall not be acceptable.

#### G. Serial Interfaces

1. The system shall include five serial interfaces. Each interface shall comply with EIA standards for RS232 and RS485. Systems that do not include these integral serial interfaces and their supported operation shall not be acceptable.
  - a. The system shall include (1) slave Class B multi-drop RS-485 serial port for optional expansion accessories such as I/O boards and local serial annunciators.
  - b. The system shall include (2) peer-to-peer RS-485 serial ports arranged in a Class A "ring" topology for the primary fire system network connecting multiple fire control panels and/or remote network annunciators.
  - c. The system shall include (1) RS-232 serial port for connection to fire or ancillary serial printers.
  - d. The system shall include (1) RS-232 serial port for connection to laptop, desktop, or handheld computer systems using Hochiki Loop Explorer configuration software and its related utilities. This port shall also support a proprietary high-level protocol for optional integration and interface to third party building automation platforms, graphics software, and other enterprise building software suites.

#### H. Notification Appliance Circuit (NAC) Output.

1. The Notification Appliance Circuit outputs shall provide four fully supervised Class B (NFPA Style Y) notification circuits.
2. The notification circuit capacity shall be 2.5 amperes maximum per circuit not to exceed 4 amperes maximum per panel based on Hochiki battery and voltage drop calculations.
3. The notification circuits shall not affect other portions of panel operations in any way during a short circuit condition.
4. The notification circuit terminal of the panel shall be UL Listed for use with up to 12ga. AWG wiring.
5. Notification circuits shall be fully programmable for variable use. The outputs may be activated by common alarm, general event categories, zoned, point, or logic triggered operation. NACs shall support silence-able and strobe output options, as well as audible patterns for horns. NACs shall have optional settings for non-NAC operation such as continuous, door holder, and reset-able power functions.

#### I. Auxiliary Programmable Inputs and Outputs

1. The panel shall provide eight (8) auxiliary programmable logic input circuits. The inputs may be programmed to any type of secondary ancillary logic operation.
2. The panel shall include five (5) programmable relay outputs and three (3) programmable 24vdc voltage outputs. The voltage outputs shall be rated at 500mA each.

3. Each input or output shall be capable of fully independent operation and can be involved independently in network-wide Cause and Effect logic programming via Hochiki Loop Explorer software.
4. Each input or output shall be capable of independent enable/disable conditions via timed and un-timed settings via menu commands when front panel controls are in Access Level 2 or in key-switch enabled mode.

#### J. Enclosures

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and door shall be corrosion, rust, and vandal resistant.
2. The cabinet and door shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the sides, top, and bottom of the cabinet.
3. The door shall provide a key lock and an opening to access the control buttons. An alternate build of the FireNET panel shall include a plexiglass window for viewing the LCD and all LED indicators. The control buttons and indicators shall be inaccessible behind the window when the door is locked in the closed position. When the door is opened the panel will enter access level 2 automatically. This alternate build shall be used where required by the AHJ. For convenience, the door may be removed to facilitate installation of system wiring or ease of use. The removable door shall have a hinge pins to facilitate quick removal without damage to system electronics. The bottom hinge pin shall be longer to allow easy guided re-installation of the door after removal.
4. The cabinet shall include a designated earth ground stud identified with a label containing appropriate earth ground symbol per UL864 9th edition, NFPA-70, and applicable building and safety electrical codes.
5. The cabinet shall include a grounding block to receive shielded drain wires and other low-voltage grounding needs.
6. The cabinet shall include a removable back-plane for mounted electronics allowing quick and easy removal to facilitate installation of system wiring or ease of use without damage to system electronics.

#### K. FACP Power Supply

1. The panel power supply output shall be rated at 4.0 Amps for internal panel power and external SLC, NAC, and other auxiliary power needs. The battery charger shall be rated at 1.25 Amps and shall not detract from the 4.0 Amp total output current.
2. Positive-Temperature-Coefficient (PTC) fuses or other over-current protection shall be provided on primary AC input, DC power output, and battery input.
3. The primary AC input power shall have dual operating voltage capability at 120/240 VAC, 50/60 Hz, and shall provide all necessary primary power for the panel.
4. The power supply shall provide an integral battery charger for use with batteries up to 60 AH. Battery arrangement may be configured in the field per the manufacturer's recommended methods.
5. The power supply shall meet new UL864 9th edition requirements introduced in 2005/2006 per the updated control panel standard. The power supply shall be capable of handling NAC and surge transients outlined in the new standard. DC power outputs shall be UL listed for "Regulated" use.

#### L. Other Specific System Operations

1. Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all analog/addressable intelligent detectors and sensors in the system from the system keypad or via Hochiki Loop Explorer configuration software. Sensitivity ranges shall be within the allowed UL window.

2. Alarm Verification: The analog/addressable smoke detectors and sensors in the system may be enabled for verification per zone.
3. Point Disable: Individual inputs, outputs, SLC, NAC, zones, or all audible devices in the system may be enabled or disabled on a timed or un-timed basis through the panel user interface.
4. Point Status: The system shall be able to display or print the following point status diagnostic functions:
  - a. Device status
  - b. Device type
  - c. Custom device label
  - d. View analog detector values
  - e. Device zone assignments
  - f. All program parameters
5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. The buffer shall be prioritized such that higher priority events (example: fire) are retained as lower priority events are dropped, keeping the highest priority items present in the 500 event buffer. Systems that do not have this capability are not suitable substitutes. Each of the system events shall be stored with a date/time stamp that includes actual time of the activations and restores. The contents of the history buffer may be manually viewed or printed, one event at a time, by event category, or in its entirety. The history buffer may also be uploaded to the Hochiki Loop Explorer software to be viewed or printed from a computer or stored as a Microsoft Excel file.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector or sensor and shall analyze the detector responses over a period of time. If any intelligent detector or sensor in the system responds with a reading that is above or below normal limits, the system will generate one of two maintenance troubles, and the particular detector or sensor will be annunciated on the system display and/or printed on the optional printer. There shall be two maintenance trouble types. 1: early warning; service unit. 2: outside limits, service or replace unit. When trouble 1 occurs units will continue to operate; when trouble 2 occurs the units may no longer function properly. The automatic early warning feature (trouble 1) shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform. In addition with Hochiki Loop Explorer software it shall be possible to download a printed report showing the exact numeric analog condition of every analog/addressable photoelectric or ionization smoke detector/sensor in the system. It shall also be possible to view the health of each individual detector or sensor as a color status bar in the Loop Explorer software indicating the device condition. Systems that do not offer an automatic early warning feature, maintenance reports, or viewing software for device health shall not be acceptable.
7. The fire alarm control panel shall include a one man walk test feature. It shall include the ability to test initiating devices and notification appliance circuits from the field without returning to the panel to operate the system. Operation shall be as follows:
  - a. Alarming an initiating device shall activate notification and other outputs that are programmed for General Alarm when placed in walk test mode.
  - b. Walk Test mode shall be recorded in the history buffer.
  - c. Walk Test mode shall automatically time out after 15 minutes from the last device tested. The system will automatically return to normal detection and alarm operation after this timeout.

- d. Walk Test mode shall have the option to have audible or silent operation of system notification outputs during test modes.

8. Water-flow Operation

An alarm from a water-flow detection device shall activate the appropriate alarm message on the system display and turn on all programmed notification appliance circuits. Water-flow inputs shall have the option of not being affected by the alarm silence switch.

9. Supervisory Operation

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory alarm LED, but will not cause the system to enter the trouble or fire alarm mode.

10. Alarm Silence Operation

The panel shall have the ability to program each output circuit (notification, relay, module, etc) to deactivate upon depression of the alarm silence switch. The alarm silence operation shall only operate when the system is placed in Access Level 2.

11. Non-Alarm Input Operation

Any input in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices. The following optional secondary input event types shall be available:

- a. Emergency
- b. Auxiliary
- c. Trouble
- d. Pre-Alarm
- e. Security
- f. Test
- g. Disable
- h. Transparent

M. System Configuration Software Utility

1. The software shall be Hochiki America Loop Explorer for Windows.
2. The software shall support standard Microsoft Windows programming styles such as drag & drop, cut & paste, hot keys/short cuts, auto-fill, etc. Systems that do not support this style programming shall not be accepted.
3. Zone Manager: Allows quick drag & drop or cut & paste style programming of system input/output to any of (500) zones.
4. Quick Config: Allows each SLC loop to be placed in spreadsheet format to allow quick and easy programming of location text and zones. Feature must support cut & paste style programming.
5. System Print/Pre-view: Allow all programming attributes to be viewed and saved as a Microsoft Word document for "as-built" programming records.

6. Advanced Cause & Effect logic: Supports up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE" operators to be used for advanced programming. Supports three styles of logic: actions, disablements, and test zones. The Cause and Effect logic shall operate network-wide and shall not be restricted to a single panel or network node.
7. Advanced configuration download/upload: Allows configuration loads via a single connection to a single panel or node on the network. Any and all panels or nodes may be loaded from a single point. Eliminates the need to go to each panel or node to perform configuration loading. Systems that do not have this feature shall not be acceptable.
8. Virtual Panel mode: Allows virtual control of any panel or node as if standing at the control unit from a single panel or node connection on the network. Any panel or node may be accessed from any other single panel or node connection. Systems that do not have this feature shall not be acceptable.
9. Event Log: Allows event logs from any panel or node on the network to be viewed and extracted to the software utility and saved as a Microsoft Excel spreadsheet.
10. Analog Values: Allows last calibrated and drift compensated sensor/detector values to be viewed on a SLC loop basis and saved as a Microsoft Excel spreadsheet.
11. Monitor Mode: Allows real-time event monitoring of any panel or node directly connected to the software utility to be viewed and saved as a Microsoft Word document. This document can be a record of inspection or test activity and provided to the AHJ as an electronic or printed test record. This eliminates the need for hand written records.
12. Advanced Help Functions: Software utility shall include embedded help library with components from the installation and programming manual. An embedded online help function shall be included that links to the manufacturers product and support website. A built-in email link to the manufacturers Tech Support department shall also be included.

#### 2.4. MAIN FIRE ALARM CONTROL PANEL (FireNET Plus)

##### A. General

Main FACP or network node shall be a Hochiki FireNET Plus Series fire alarm control panel (e.g. FNP-1127, FNP-1127D, etc.) and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, annunciators, expansion accessories, and other system controlled devices. The main FACP, networked nodes, and related system options shall consist of one or more of the following Hochiki America primary FireNET product line identifiers:

FNP-1127	Fire Alarm Control Panel (1 loop, no DACT)
FNP-1127E	Fire Alarm Control Panel (1 loop, no DACT, expandable)
FNP-1127D	Fire Alarm Control Panel (1 loop with DACT)
FNP-1127DE	Fire Alarm Control Panel (1 loop with DACT, expandable)
FN-4127-NIC	Network Interface Card
FNP-1127-SLC	(1) Loop Expander Card

## B. Operator Control

### 1. Panel Sounder Silence:

- a. Activation of the control Panel Sounder Silence button in response to new alarms and/or troubles shall silence the local panel sounder signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of the "More Alarms" or "More Events" buttons shall advance the LCD display to the next alarm or trouble condition.
- b. Depression of the Panel Sounder Silence button shall also silence all Remote Annunciator panel sounders if so programmed per network node configuration.

### 2. Alarm Silence Button:

Activation of the Alarm Silence button shall cause all silenceable alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this button shall be fully field programmable within the confines of all applicable standards. The FACP software shall include optional auto-silence timers. The fire alarm panel display will continue to illuminate the "Fire" LED, and the Panel Sounder Silence yellow LED will indicate steadily until the fire alarm panel is RESET and the conditions are clear. Should other types of alarm or trouble conditions be present, the system shall respond accordingly and the appropriate LEDs associated with this category of alarm or trouble will indicate until the panel has been restored to normal condition. Subsequent alarms, if any, will activate the alarm notification appliances and relays again.

### 3. Fire Drill Button:

The Fire Drill button shall activate all notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation. The drill function shall latch these circuits and devices "on" until the panel is silenced or reset. The two red "Fire" LEDs shall flash, the yellow "On Test" LED shall indicate steadily on the panel display and the LCD display shall display "Fire Drill". Pressing the Fire Drill or Reset button shall silence and reset all related circuits and devices.

### 4. ReSound Alarm Button:

Pressing the "ReSound Alarm" button on the front display at any time after the FACP has been silenced, but not Reset, will re-activate the notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation back into the appropriate alarm condition.

### 5. System Reset Button:

Activation of the System Reset button shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, and annunciator displays to return to their normal condition. Addressable duct detector relays will also return to normal condition provided an auxiliary relay has been configured to interrupt power to the duct detector or if a NAC circuit configured as "Resettable" is being used to power the detector.

6. Lamp Test:

The Lamp Test button shall activate all local system LEDs and illuminate each segment of the liquid crystal display (LCD) while the Lamp Test button is depressed.

7. Programmable Function:

The Programmable Function button shall be user programmable and shall activate any programmed action or output, or group of actions or outputs associated with programmed Cause and Effect software control to function with the operation of this button.

Associated LEDs or display codes will appear on the FACP display as needed to indicate the category of the programmed function. The programmable function button will only activate when the button is pressed during Level 2 password access or when the front panel "Enable" key switch is on.

8. Enter:

The Enter button shall be used as necessary in association with the keypad to enter various commands, menus, or system modes.

9. Exit:

The Exit button shall be used to exit any level of access, various commands, menus, or system modes and return the display to its original condition.

10. More Events:

The More Events button shall be used by the system operator to view additional alarm, trouble, supervisory or other event category conditions as they occur or have occurred on the FACP. The most current events shall be displayed first. Older events shall be displayed last. The system will automatically continue to organize and display events as they occur in real time. The events displayed in this menu are active and current events (current event buffer). For viewing historical events that have already been restored, the user must view the event history log.

11. More Fire Events:

The More Fire Events button shall be used to display all high priority "Fire" alarm conditions on the panel. The LCD display will display two fire alarm events at a time. The first (original) and last (latest) fire alarm events will be displayed by default. When the More Fire Events button is used, the system will cycle the last fire alarm event entry through all currently active fire alarm events, keeping the originating event concurrently displayed. The system will automatically continue to categorize and display alarm events as they occur in real time.

12. Numeric/Arrow Navigation Buttons:

The numeric arrow buttons shall be used by the system technician and/or other appropriate personnel to enter the Access Level 2 or 3 menu structures. From these menus personnel can perform programming functions, disablements, set system time, device parameters, printers, maintenance alerts, etc. The Access Level 2 menu functions are for standard user functions and system operation. The Access Level 3 menu functions are for system programming and higher-level administrator operations.

13. Question Button (?):

The Question button shall be used by the system operator or technician to provide help to describe the particular menu or level the operator is currently in. For example, pressing the help button when the panel is in alarm mode will explain to the operator what is occurring and suggest appropriate action. Fire alarm systems that do not provide dynamic onboard front panel help via a menu function shall not be acceptable.

C. System Capacity and General Operation

1. The control panel or network node shall provide, or be capable of, SLC input/output capacity of 800 addresses and sub-addresses at full panel expansion.
2. The control panel or network node shall support (1) or (2) SLC loop configurations.
3. The control panel or network node shall support (127) sensors/detectors/modules and (127) addressable sounder bases per loop totaling up to 254 addressable points per SLC loop. Systems that are not capable of this SLC capacity shall not be acceptable.
4. The control panel or network node shall include five (3) onboard programmable Form-C relays with default operation for Fire, Trouble, and Supervisory. The relays shall be rated for a minimum of 1.0 amp @ 30VDC.
5. Each FireNET plus control panel shall include two (2) onboard Class B (NFPA Style Y) programmable Notification Appliance Circuits. Each circuit shall be rated for 2.3 amps @ 24VDC.
6. Each FACP NAC and relay output may be individually programmed to operate on any pre-defined condition via Cause and Effect programming.
7. The control panel or network node shall include (500) network-wide zones. Systems that do not employ this type of zoning shall not be acceptable.
8. Protection: All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with the requirements of the UL864 9th edition standard.
9. Field Wiring Terminal Blocks: For ease of installation and service, all panel I/O wiring terminal blocks shall have sufficient capacity for #18 to #12 AWG wire. The terminal blocks shall be removable.
10. The control panel or network node shall include and employ (2) RS485 network ports configured in a Class A "ring" topology for high integrity operation. Systems that employ a single RS485 port or Class B 2-wire network operation shall not be acceptable.
11. The control panel or network node shall include a slave RS485 port for remote expansion accessories. This expansion port shall support up to (32) optional remote expansion accessories with a capacity of up to (512) secondary inputs and outputs or (15) local serial LCD annunciators and (17) expansion accessories. Systems that do not employ a slave RS485 port for expansion accessories shall not be acceptable.
12. The control panel or network node shall include (1) onboard RS232 port for PC programming.
13. The control panel or network node shall include (1) onboard RS232 port for 3rd party serial fire printer support.
14. Protection: the control panel or network node shall incorporate surge and lightning protection devices as required to meet the UL 864 9th Edition criteria.
15. The system shall include a full featured operator interface control and annunciation panel that shall include a (320) character backlit (8 lines x 40 characters) Liquid Crystal Display (LCD), with individual color coded system status LEDs, and a keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
16. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The memory storage of the system shall be Flash memory type; EPROM type shall not be acceptable.

17. The system shall allow the programming of any input to activate any output or group of outputs via advanced Cause & Effect software programming. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or have only basic logic programming are not considered suitable substitutes.
18. The FACP shall support up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE" operators to be used for advanced programming. Logic statements shall require the use of a PC with Hochiki Loop Explorer software utility designed for programming. The logic statements shall support special macro operations to perform advanced automated system bypass disablements and multi-zone One Man Walk Test functions. Systems that do not employ this Cause & Effect capability, capacity, or special logic macros shall not be acceptable.
19. The FACP or network node shall include the following features:
  - a. Automatic drift compensation employed per UL864 9th Edition criteria where each smoke sensor/detector automatically adjust its zero-point, fire-point, and alarm threshold sensitivity to adjusted ambient environmental conditions ("clean-air" samples) taken within each (24) hour period. This operation adjusts each smoke sensor/detector automatically to suit ongoing subtle changes in the ambient air conditions. The adjusted values and operation ensure smoke sensors/detectors are always optimally tuned to their environment and do not fail to operate or false alarm as the smoke chambers slowly become dirty or obscured. Systems that do not employ automatic drift compensation to the UL864 9th Edition criteria shall not be acceptable.
  - b. Integral detector sensitivity test method between the control unit and the smoke sensor/detector that meets the requirements of NFPA 72 and UL 864 9th edition. Systems that do not employ an integral detector sensitivity test method shall not be acceptable.
  - c. Early warning maintenance alert to warn of increasing dirt, dust, or other obscuration accumulation in the smoke sensor/detector chamber, or if the device drifts out of factory nominal ranges indicating a potential maintenance trouble condition. Systems that do not employ an early warning maintenance alert function shall not be acceptable.
  - d. Two individual variable sensitivity levels of alarm for each sensor/detector in the system, one for Day mode, and another for Night mode. The alarm level range shall be .88 to 3.57 of obscuration percent per foot for ALG-V analog/addressable photoelectric smoke sensors/detectors, and 0.5 to 3.8 for ALK-V analog/addressable photoelectric smoke sensors/detectors. Analog/addressable duct detectors shall have a range of 0.88 to 2.57 percent per foot. Analog/addressable ionization smoke detectors shall have sensitivity assigned according to fixed values set to low, medium, or high. Analog/addressable thermal heat sensors/detectors shall have an alarm level range of 32 - 158 degrees Fahrenheit, but are UL listed for fire when set between 135 - 150 degrees Fahrenheit.
  - e. The system shall also include an automatic dynamic pre-alarm function assigned as a fixed relationship to the adjustable alarm threshold or sensitivity of a given sensor/detector. The dynamic pre-alarm value varies automatically with each sensor's/detector's sensitivity setting and is adjusted across the sensor/detector range. This allows for a continuously variable multi-step pre-alarm operation. Pre-alarm function can be turned on and off manually via programming option.
  - f. The ability to display or print system reports, loop/zone configurations, and history events.
  - g. Alarm verification of smoke sensor/detector zones per UL864 9th Edition criteria. Alarm verification time value shall be programmable from (5) to (60) seconds in (5) second intervals.

- h. The ability to link inputs to outputs and/or to group inputs and outputs using Hochiki Loop Explorer Cause and Effect Wizard via simple point/click and menu driven programming. Systems that use DOS commands, machine language commands, executable statements, or #,+ -, or other non-standard unique programming styles are not acceptable.
  - i. Rapid alarm reporting with Hochiki DCP digital fire detection protocol supporting 1.5 second alarm response reporting worst case on any given SLC. All system nodes shall meet NFPA 72 requirements for alarm activation from initiation to notification within 10 seconds. Systems that do not meet this requirement and ability shall not be acceptable.
  - j. Automatic daily sensor/detector calibration and test function conducted by the control panel. This system shall automatically test and calibrate every sensor/detector in the system every (24) hours and perform drift compensation during each calibration event. Systems that do not employ automatic daily calibration and self test function shall not be acceptable.
  - k. Cross zoning (Coincidence operator) function: Any two objects of a subset applied in the "Cause" section of Cause & Effect using the "Coincidence" operator, will activate the output action subset outlined in the "Effect" section of Cause & Effect from any two objects defined in the "Cause" section of Cause & Effect. This function allows any two "Cause" input objects such as two detectors, two software zones, one detector and one software zone, one smoke detector and one thermal detector, or any combination of two inputs and/or zones to operate in a cross-zoned fashion via Hochiki Loop Explorer Cause and Effect Programming.
  - l. One Man Walk test mode with optional Cause & Effect driven macros for automated multi-zone One Man Walk Test mode operation.
  - m. Automatic day/night mode adjustment of sensor/detector sensitivities based on unique daily time schedules on a weekly basis.
  - n. Advanced auto-learn feature that learns all SLC loop devices and addresses, internal control panel and expansion structure, and network relationship to other nodes. The default learned configuration assumes safest UL864 and NFPA 72 compliant settings and attributes for all system components such that the system will not need further programming to operate in General Alarm mode. This allows the system to operate "out-of-the-box" after an auto-learn is performed. Systems that do not employ an advanced auto-learn function in this manner shall not be acceptable.
20. The FACP shall be capable of coding control panel notification appliance circuits in March Time, Temporal 3 (per NFPA 72/ANSI), and Continuous patterns for notification appliance devices. In addition, notification appliance sync protocols shall be supported for Wheelock, Gentex, System Sensor and Amseco/Potter.
21. Network Communication
- a. The network architecture shall be based on a communications package that utilizes a peer-to-peer, inherently regenerative highly secure format and protocol. A node may be an intelligent Fire Alarm Control Panel (FACP) or Network Remote Annunciator/Control Station (RNA). The network shall be capable of expansion to at least (64) panels and/or nodes.
  - b. Each network node address shall be capable of storing up to (500) events. Any network node can serve as a reporting or control node for another node if necessary by programming the necessary network routing attributes.

- c. The network shall be capable of communicating via wire. A wire network shall include a fail-safe means of isolating the nodes in the unlikely event of complete power loss to a node. Loss of a network node, cable short-circuit, cable open-circuit, or fault of network communications shall activate a trouble signal on the network nodes (panels and network annunciators) programmed with the necessary network routing attributes. The wire network shall include and employ (2) RS485 network ports configured in a Class A "ring" topology for high integrity operation. The Class A "ring" topology network operation shall communicate in both directions over both ports and not be degraded by a single break anywhere on the network. The network wiring shall be a minimum (20) gauge twisted shielded pairs suitable for RS485 style communications. The network transmission shall be capable of (4000) feet between each node. The overall network wire length shall be capable of (256,000) feet in the maximum network configuration. Systems that employ a single RS485 port or Class B 2-wire network or that do not perform in the above manner shall not be acceptable.
- d. Network Fire alarm panels or nodes shall be capable of up to (500) software zones that may be assigned network-wide. Panels and network nodes shall not be restricted to unique zones. Any zone may be used by any combination of panels and network nodes. Systems that do not employ network-wide zoning or have zoning restrictions shall not be acceptable.
- e. Network process and event handling shall be capable of independently and separately routing each system event type and/or control from any network node to and from any other network node. The network shall be capable of routing the following individual types of event categories:
  1. Fire
  2. Supervisory
  3. Trouble
  4. Pre-Alarm
  5. Emergency
  6. Auxiliary
  7. Security
  8. Disablements (Bypass events)
  9. Test (Walk Test events)
  10. Status & Control (system status/panel controls)

The network shall be capable of individually handling each of the above types of event categories as follows:

1. Process (act on the network event)
2. Display (display the network event)
3. Log (record the network event)
4. Print (print the network event)
5. Buzz (activate the buzzer from the network event)

Each network node shall be capable of having unique network routing assignments. Each network node shall be capable of receiving any and all network events from any and all other network nodes. Each network node shall be capable of receiving all events from a maximum size network of (64) nodes, which supports (51,200) addresses/sub-addresses within the (84,484) total system points possible. Systems that do not support these network capabilities shall not be acceptable.

#### D. Central Microprocessor

1. The microprocessor shall be state-of-the-art and shall communicate with, monitor and control all external interfaces. It shall include Flash memory for system program and site-specific configuration storage, and shall include a supervised "watch dog" circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all programs for specific actions to be taken if an alarm condition is detected by the system. Site-specific programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time/date annotation of system displays, printer, and history log. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real-time clock shall have an option for Daylight Savings Time. The real time clock shall also control panel functions such as Day/Night mode, Calibration, Alarm Verification, AC Failure Delay, Sounder Timeout, and I/O timer functions per their respective programmed settings.
4. The microprocessor shall utilize Hochiki FireNET DCP system protocol for efficient reliable communications with addressable analog addressable devices.
5. An auto-program (auto-learn) function shall be provided to quickly install initial default functions, SLC devices, and network attributes and make the system operational.
6. For flexibility and to ensure program validity, all system programs and functions shall be configured with the System Configuration Software Utility (Hochiki Loop Explorer software). This program shall be used to off-line program the system with batch upload/download functions, and shall have the ability to upgrade the manufacturer's (FLASH) operating system firmware code.

#### E. System Display and User Interface

1. The system shall support the following Liquid Crystal Display (LCD) properties:
  - a. Panel and annunciator displays shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of any other panel or network annunciator display if so programmed via network routing attributes.
  - b. The LCD display shall have a contrast adjustment to set to contrast intensity of the display.
  - c. The LCD display shall include a ¼" plexi-glass clear protector cover to prevent field damage and to provide security protection from vandalism
  - d. The LCD display shall provide comprehensive information for system events, menus, and devices. At a minimum the following shall be displayed: date, time, node#, loop#, zone#, address#, sub-address#, device type, event category, specific event type, action message, and (40) character location text. Menu text shall display complete and unabbreviated verbiage. Systems that support less than (320) characters total, (8) lines total, (40) characters of location text, or employ abbreviated text shall not be acceptable.
2. The system shall provide indications and controls on the front panel or annunciator user interface as follows:
  - a. Control buttons: Panel Sounder Silence, Alarm Silence, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test.

- b. Light-Emitting Diode (LED) indicators: AC Power On, Fire Alarm, Pre-Alarm, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications are not acceptable.
- c. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons.
- d. The system user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming.
- e. The system shall support easy entry of password codes via navigation system or key switch to easily access level 2 or level 3 command menus.

F. Signaling Line Circuits (SLC)

- 1. Each FACP or FACP network node shall support up to (2) SLC loops. Each SLC loop shall provide power to and communicate with up to (127) analog addressable sensors/detectors (ionization, photoelectric, duct, and/or thermal) and addressable modules (input monitor, addressable pull-station, output relay, conventional zone, and/or supervised output), along with (127) addressable sounder bases for a loop capacity of up to (254) SLC devices. The (1) loop base panel shall be capable of supporting (254) SLC devices. When the one-loop expander is used the (2) loop panel shall be capable of (508) devices; however the maximum number of addresses and sub-addresses is 800 per panel.
- 2. SLC wiring shall support a wiring distance of up to 5,000 feet per circuit.
- 3. Individual FireNET Plus panels can be networked up to (64) nodes to provide a maximum of (51,200) addresses/sub-addresses within the (83,968) total system points possible. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
- 4. The FACP shall receive analog information from all analog addressable sensors/detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each sensor/detector. The software shall automatically maintain the sensor/detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each sensor/detector. The panel will assess the sensor/detector analog data to determine when the fire condition is reached and the alarm must be generated. The analog information shall also be used for automatic detector testing/calibration and for the automatic determination of detector maintenance requirements. See Drift Compensation and Calibration portions of this document for additional details.
- 5. Point monitor modules shall be programmable for one of (13) different types of event categories depending on the module type: fire, trouble, pre-alarm, supervisory, emergency, auxiliary, security, silence, reset, fire drill, transparent, disablement, or test mode. In addition, each point shall be capable of being assigned an action message. There shall be (20) action messages total (11 preset and 9 custom with up to 15 characters each). Each point shall have the capacity for up to (40) alphanumeric characters. In addition any monitor module can, via its selected program, individually override alarm output delays, set an input delay time, and support advanced programming options. NFPA, UL, AHJ, and local, state, and federal codes must be observed. Systems without this capability shall not be acceptable.

## G. Serial Interfaces

1. The system shall include five serial interfaces. Each interface shall comply with EIA standards for RS232 and RS485. Systems that do not include these integral serial interfaces and their supported operation shall not be acceptable.
  - a. The system shall include (1) slave Class B multi-drop RS-485 serial port for optional expansion accessories such as I/O boards and local serial annunciators.
  - b. The system shall include (2) peer-to-peer RS-485 serial ports arranged in a Class A "ring" topology for the primary fire system network connecting multiple fire control panels.
  - c. The system shall include (1) RS-232 serial port for connection to fire or ancillary serial printers.
  - d. The system shall include (1) RS-232 serial port for connection to laptop, desktop, or handheld computer systems using Hochiki Loop Explorer configuration software and its related utilities. This port shall also support a proprietary high-level protocol for optional integration and interface to third party building automation platforms, graphics software, and other enterprise building software suites.

## H. Notification Appliance Circuit (NAC) Output.

1. The Notification Appliance Circuit outputs shall provide two fully supervised Class B (NFPA Style Y) notification circuits.
2. The notification circuit capacity shall be 2.3 amperes maximum per circuit not to exceed 3.1 amperes maximum per panel based on Hochiki battery and voltage drop calculations.
3. The notification circuits shall not affect other portions of panel operations in any way during a short circuit condition.
4. The notification circuit terminal of the panel shall be UL Listed for use with up to 12ga. AWG wiring.
5. Notification circuits shall be fully programmable for variable use. The outputs may be activated by common alarm, general event categories, zoned, point, or logic triggered operation. NACs shall support silence-able and strobe output options, as well as audible patterns for horns. Built-in synchronization protocols for Wheelock, Amseco/Potter, System Sensor and Gentex shall be supported. NACs shall have optional settings for non-NAC operation such as continuous, door holder, and reset-able power functions.

## I. Relay Outputs

1. The panel shall include three (3) programmable relay outputs. The relays shall be rated for a minimum of 1.0 amp @ 30VDC.
2. Each relay output shall be capable of fully independent operation and can be involved independently in network-wide Cause and Effect logic programming via Hochiki Loop Explorer software.
3. Each relay output shall be capable of independent enable/disable conditions via timed and un-timed settings via menu commands when front panel controls are in Access Level 2 or in key-switch enabled mode.

## J. Enclosures

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and door shall be corrosion, rust, and vandal resistant.
2. The cabinet and door shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the sides, top, and bottom of the cabinet.

3. The door shall provide a key lock and an opening to access the control buttons. For convenience, the door may be removed to facilitate installation of system wiring or ease of use. The removable door shall have a hinge pins to facilitate quick removal without damage to system electronics. The bottom hinge pin shall be longer to allow easy guided re-installation of the door after removal.
4. The cabinet shall include a designated earth ground stud identified with a label containing appropriate earth ground symbol per UL864 9th edition, NFPA-70, and applicable building and safety electrical codes.
5. The cabinet shall include a grounding block to receive shielded drain wires and other low-voltage grounding needs.

K. FACP Power Supply

1. The panel power supply output shall be rated at 4.0 Amps for internal panel power and external SLC, NAC, and other auxiliary power needs. The battery charger shall be rated at 1.25 Amps and shall not detract from the 4.0 Amp total output current.
2. Positive-Temperature-Coefficient (PTC) fuses or other over-current protection shall be provided on primary AC input, DC power output, and battery input.
3. The primary AC input power shall have dual operating voltage capability at 120/240 VAC, 50/60 Hz, and shall provide all necessary primary power for the panel.
4. The power supply shall provide an integral battery charger for use with batteries up to 60 AH. Battery arrangement may be configured in the field per the manufacturer's recommended methods.
5. The power supply shall meet new UL864 9th edition requirements introduced in 2005/2006 per the updated control panel standard. The power supply shall be capable of handling NAC and surge transients outlined in the new standard. DC power outputs shall be UL listed for "Regulated" use.

L. Other Specific System Operations

1. Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all analog/addressable intelligent detectors and sensors in the system from the system keypad or via Hochiki Loop Explorer configuration software. Sensitivity ranges shall be within the allowed UL window.
2. Alarm Verification: The analog/addressable smoke detectors and sensors in the system may be enabled for verification per zone.
3. Point Disable: Individual inputs, outputs, SLC, NAC, zones, or all audible devices in the system may be enabled or disabled on a timed or un-timed basis through the panel user interface.
4. Point Status: The system shall be able to display or print the following point status diagnostic functions:
  - a. Device status
  - b. Device type
  - c. Custom device label
  - d. View analog detector values
  - e. Device zone assignments
  - f. All program parameters

5. **System History Recording and Reporting:** The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. The buffer shall be prioritized such that higher priority events (example: fire) are retained as lower priority events are dropped, keeping the highest priority items present in the 500 event buffer. Systems that do not have this capability are not suitable substitutes. Each of the system events shall be stored with a date/time stamp that includes actual time of the activations and restores. The contents of the history buffer may be manually viewed or printed, one event at a time, by event category, or in its entirety. The history buffer may also be uploaded to the Hochiki Loop Explorer software to be viewed or printed from a computer or stored as a Microsoft Excel file.
6. **Automatic Detector Maintenance Alert:** The fire alarm control panel shall automatically interrogate each intelligent detector or sensor and shall analyze the detector responses over a period of time. If any intelligent detector or sensor in the system responds with a reading that is above or below normal limits, the system will generate one of two maintenance troubles, and the particular detector or sensor will be annunciated on the system display and/or printed on the optional printer. There shall be two maintenance trouble types. 1: early warning; service unit. 2: outside limits, service or replace unit. When trouble 1 occurs units will continue to operate; when trouble 2 occurs the units may no longer function properly. The automatic early warning feature (trouble 1) shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform. In addition with Hochiki Loop Explorer software it shall be possible to download a printed report showing the exact numeric analog condition of every analog/addressable photoelectric or ionization smoke detector/sensor in the system. It shall also be possible to view the health of each individual detector or sensor as a color status bar in the Loop Explorer software indicating the device condition. Systems that do not offer an automatic early warning feature, maintenance reports, or viewing software for device health shall not be acceptable.
7. The fire alarm control panel shall include a one man walk test feature. It shall include the ability to test initiating devices and notification appliance circuits from the field without returning to the panel to operate the system. Operation shall be as follows:
  - a. Alarming an initiating device shall activate notification and other outputs that are programmed for General Alarm when placed in walk test mode.
  - b. Walk Test mode shall be recorded in the history buffer.
  - c. Walk Test mode shall automatically time out after 15 minutes from the last device tested. The system will automatically return to normal detection and alarm operation after this timeout.
  - d. Walk Test mode shall have the option to have audible or silent operation of system notification outputs during test modes.
8. **Water-flow Operation**

An alarm from a water-flow detection device shall activate the appropriate alarm message on the system display and turn on all programmed notification appliance circuits. Water-flow inputs shall have the option of not being affected by the alarm silence switch.
9. **Supervisory Operation**

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory alarm LED, but will not cause the system to enter the trouble or fire alarm mode.

10. Alarm Silence Operation

The panel shall have the ability to program each output circuit (notification, relay, module, etc) to deactivate upon depression of the alarm silence switch. The alarm silence operation shall only operate when the system is placed in Access Level 2.

11. Non-Alarm Input Operation

Any input in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices. The following optional secondary input event types shall be available:

- a. Emergency
- b. Auxiliary
- c. Trouble
- d. Pre-Alarm
- e. Security
- f. Test
- g. Disable
- h. Transparent

M. System Configuration Software Utility

1. The software shall be Hochiki America Loop Explorer for Windows.
2. The software shall support standard Microsoft Windows programming styles such as drag & drop, cut & paste, hot keys/short cuts, auto-fill, etc. Systems that do not support this style programming shall not be accepted.
3. Zone Manager: Allows quick drag & drop or cut & paste style programming of system input/output to any of (500) zones.
4. Quick Config: Allows each SLC loop to be placed in spreadsheet format to allow quick and easy programming of location text and zones. Feature must support cut & paste style programming.
5. System Print/Pre-view: Allow all programming attributes to be viewed and saved as a Microsoft Word document for "as-built" programming records.
6. Advanced Cause & Effect logic: Supports up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE" operators to be used for advanced programming. Supports three styles of logic: actions, disablements, and test zones. The Cause and Effect logic shall operate network-wide and shall not be restricted to a single panel or network node.
7. Advanced configuration download/upload: Allows configuration loads via a single connection to a single panel or node on the network. Any and all panels or nodes may be loaded from a single point. Eliminates the need to go to each panel or node to perform configuration loading. Systems that do not have this feature shall not be acceptable.
8. Virtual Panel mode: Allows virtual control of any panel or node as if standing at the control unit from a single panel or node connection on the network. Any panel or node may be accessed from any other single panel or node connection. Systems that do not have this feature shall not be acceptable.
9. Event Log: Allows event logs from any panel or node on the network to be viewed and extracted to the software utility and saved as a Microsoft Excel spreadsheet.
10. Analog Values: Allows last calibrated and drift compensated sensor/detector values to be viewed on a SLC loop basis and saved as a Microsoft Excel spreadsheet.

11. Monitor Mode: Allows real-time event monitoring of any panel or node directly connected to the software utility to be viewed and saved as a Microsoft Word document. This document can be a record of inspection or test activity and provided to the AHJ as an electronic or printed test record. This eliminates the need for hand written records.
12. Advanced Help Functions: Software utility shall include embedded help library with components from the installation and programming manual. An embedded online help function shall be included that links to the manufacturers product and support website. A built-in email link to the manufacturers Tech Support department shall also be included.

## 2.5. SYSTEM COMPONENTS - EXPANSION AND ACCESSORIES

### A. General

Control panel expansion and accessories shall be one or more of the following Hochiki America primary FireNET series product line identifiers:

FN-LCD-N	Network Annunciator (RNA)
FN-LCD-S	Local Serial Annunciator (LSA)
FN-4127-IO	(16) Input/Output Expander Board (IOM)
FN-CTM	City-Tie Module [local energy] (CTM)
FN-ACC	Accessory/Battery Extension Enclosure (ACC)
FN-ETR/FNP-ETR	Enclosure Trim Ring (ETR)
FN-ULADA Series	Remote NAC Booster (RNB)
FN-ULX Series	Auxiliary Power Supply (APS)
FN-DAC	Digital Alarm Communicator/Transmitter (DACT)
FNP-LED	Graphics LED Display (GLD)
Graphix	Graphix Software for PC (GUS)
VoiceNET	Voice Evacuation System (FNV)

### B. Remote Network Annunciator (RNA)

1. The RNA shall be Hochiki America model FN-LCD-N.
2. The RNA shall be capable of displaying all information for all possible system points on a maximum size network of (64) nodes. Same as the main FACP.
3. The RNA shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of any other panel or network annunciator display if so programmed via network routing attributes. The LCD display shall operate exactly the same as described in this document for the main FACP. The LCD display shall have the same contrast adjustment and plex-glass protection as described in this document for the main FACP.
4. Control buttons: Panel Sounder Silence, Alarm Silence, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test. Same as the main FACP.
5. Light-Emitting Diode (LED) indicators: AC Power On, (2)-Fire Alarm, Pre-Alarm, Fire Output Active, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, System Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications shall not be acceptable.
6. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons. Same as the main FACP.
7. The RNA user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming. Same as the main FACP.

8. The RNA shall support easy entry of password codes via navigation system or key-switch to easily access level 2 or level 3 command menus. Same as the main FACP.
9. Each RNA address shall be capable of storing up to (500) events. Any network node can serve as a reporting or control node for another node if necessary by programming the necessary network routing attributes. Same as the main FACP.
10. The RNA shall mount in its own steel enclosure and shall support either surface or flush mounting (when the trim ring is used). The enclosure shall be corrosion, rust, and vandal resistant. The enclosure shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the back, top, or sides of the enclosure.
11. The RNA or control panel may serve as a remote network annunciator for any other panel or network annunciator in the network.
12. The RNA shall have 24VDC power input that can be supplied via the control panel or an auxiliary UL864/UL1481 listed power supply such as the Hochiki series of auxiliary power supplies and NAC boosters. When properly supplied, the RNA shall be capable of providing 500mA of supervised power limited auxiliary 24VDC power for system accessories.
13. The RNA shall include two optically isolated industry standard RS-485 ports for network communication with other network nodes via the Class A "ring" network topology. These ports shall operate and have the capacity as described in the Main FACP and Network Communication section of this document, as well as perform all of the network routing and handling functions described therein. This allows the RNA to function as a global system annunciator, local panel annunciator, or any hybrid combination required.
14. The RNA shall include a third slave RS-485 port for remote expansion accessories. This expansion port shall support up to (32) optional remote expansion accessories with a capacity of up to (512) secondary inputs and outputs or (15) local serial LCD annunciators and (17) expansion accessories. Systems that do not employ a slave RS485 port for expansion accessories shall not be acceptable. Same as the main FACP.
15. The RNA shall include (1) onboard RS232 port for PC programming. Same as the main FACP.
16. The RNA shall include (1) onboard RS232 port for 3rd party serial fire printer support. Same as the main FACP.
17. The RNA shall include four (4) onboard programmable Form-C relays with default operation for Common Fire, Common Trouble, Common Supervisory, and Auxiliary functions rated at a minimum of 1.0 amp @ 30VDC.
18. The RNA shall include an auto-program (auto-learn) function to quickly install initial default functions, local I/O, and network attributes and make the system operational.

#### C. Local Serial Annunciator (LSA)

1. The LSA shall be Hochiki America model FN-LCD-S.
2. The LSA shall be capable of displaying all information for all possible system points on a maximum size network of (64) nodes. Same as the main FACP.
3. The LSA shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of the panel it is connected to. The LCD display shall operate exactly the same as described in this document for the main FACP. The LCD display shall have the same contrast adjustment and plex-glass protection as described in this document for the main FACP.
4. Control buttons: Panel Sounder Silence, Alarm Silence, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test. Same as the main FACP.
5. Light-Emitting Diode (LED) indicators: AC Power On, (2)-Fire Alarm, Pre-Alarm, Fire Output Active, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, System Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications shall not be acceptable.

6. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons. Same as the main FACP.
7. The LSA user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming. Same as the main FACP.
8. The LSA shall support easy entry of password codes via navigation system or key-switch to easily access level 2 or level 3 command menus. Same as the main FACP.
9. The LSA shall mount in its own steel enclosure and shall support either surface or flush mounting. The enclosure shall be corrosion, rust, and vandal resistant. The enclosure shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the back of the enclosure and ½" electrical conduit connections into the sides of the enclosure. The enclosure shall also support 2-gang, 3-gang, and 4-gang holes for standard electrical back-box and switch-box mounting styles.
10. The LSA shall have 24VDC power input that can be supplied via the control panel or an auxiliary UL864/UL1481 listed power supply such as the Hochiki series of auxiliary power supplies and NAC boosters.
11. It shall be possible to connect up to (15) LSA units to a single panel or network annunciator.
12. The LSA shall connect to the dedicated multi-drop RS-485 slave port of the panel. This port shall be a Class B two-wire serial connection and shall be capable of distances up to 4000 feet.
13. The LSA shall have throughput wiring provisions for 24VDC power and serial connections.
14. Each LSA shall mimic the main controls, LED indicators, and LCD display of the panel it is connected to.

D. Input/Output Expansion Module (IOM)

1. The IOM shall be Hochiki America model FN-4127-IO.
2. The IOM shall have 16 channels of input/output points.
3. Each channel shall be configurable as an input or output point.
4. Inputs shall be an opto-isolated, non-supervised, and pull-down type triggered from a "dry" contact input source.
5. Outputs shall be open collector transistor pull-down type that provides a "wet" voltage output (100mA max each).
6. There shall be 32 IOM modules possible per panel (512 channels of input/output points).
7. The IOM shall have simple 4 wire connection to the control panel (2 for power, 2 for data).
8. All inputs/outputs shall be assignable to global functions, any event category, and used in network wide Cause & Effect logic.
9. The IOM can be mounted locally within control panel enclosure or remotely via FN-ACC accessory enclosure up to 4000ft. from the panel.
10. Input/Outputs shall be for secondary use, not for primary fire initiation inputs or notification outputs.
11. Two LED's shall be provided for communication and power status.
12. The IOM shall be rated at 24VDC. Quiescent Current: 20mA. Current per input: 3mA max. Current per output: 100mA max. (within overall limits). Current per bank is 500mA max. (for banks 1-8 & 9-16) for 8 outputs: Total current per I/O board: 1A max.
13. The IOM shall communicate via two wire Class B multi-drop RS485 capable of distances up to 4,000 ft. The IOM shall connect to the panel or network annunciator slave RS485 port.
14. The IOM shall have terminals capable of receiving 12 AWG wire.

E. City-Tie Module [Local Energy type] (CTM)

1. The CTM shall be Hochiki America model FN-CTM.
2. The CTM terminal blocks shall be capable of accepting up to 14 AWG wire.
3. The CTM shall be configured such that the NAC EOL (end of line) device of the panel will connect directly to the CTM to ensure that supervision of NAC interface wiring is performed. This integrates the panel NAC EOL device into the CTM operation to provide full supervision of the circuit.
4. The CTM shall fit into a standard 4" electrical back box.
5. The CTM interfaces the panel to a Local Energy type City Tie monitoring circuit.
6. The CTM shall be Underwriters Laboratories Listed for the intended purpose.
7. The CTM shall have a wide operating voltage range: 12 ~ 30 VDC. The current consumption shall be 0mA in standby and 1 Amp for 0.5 seconds during alarm to operate the Master Box Trip Coil.
8. The CTM shall provide power limited operation and include transient protection.

F. Accessory/Battery Extension Enclosure (ACC)

1. The ACC shall be Hochiki America model FN-ACC.
2. The ACC shall be a UL-listed cabinet suitable for surface mounting. The cabinet and door shall be corrosion, rust, and vandal resistant.
3. The cabinet and door shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the sides, top, and bottom of the cabinet.
4. The ACC shall have mounting provisions to support remote I/O expansion accessories and power supplies when the unit is used as an accessory enclosure.
5. The ACC shall support batteries sizes above 17AH that exceed the standard panel enclosure dimensions. The ACC shall be a battery extension cabinet when used in this fashion and shall include provisions for extended wiring harness and connectors for this purpose.

G. Enclosure Trim Ring (ETR)

1. The ETR shall be Hochiki America model FN-ETR for FireNET and FNP-ETR for FireNET Plus.
2. The ETR shall be a UL-listed trim ring suitable to support semi-flush mounting of the control panel. The ETR shall be corrosion, rust, and vandal resistant.
3. The ETR shall be constructed of 16 gauge or thicker steel.

H. Remote NAC Booster (RNB)

1. The RNB shall be Hochiki America models FN-642, 842, and 1042 series NAC booster units. The RNB outputs shall be rated 24VDC at 6, 8, or 10 Amps respectively.
2. The RNB shall be remote controlled and monitored by the panel NAC output circuit or Hochiki Addressable Supervised Output Module (SOM). The NAC and/or SOM provide integrated operation of the RNB with the control panel. Each NAC or SOM shall be capable of, through system programming, deactivating upon depression of the alarm silence switch. Visual Appliances (strobes) optionally may be set to continue to flash during alarm silence with the appropriate hardware and software settings.
3. The terminal strips shall be UL listed for use with up to 12 AWG wire.
4. RNB shall include 1 Amp of 24vdc filtered regulated un-switched power for constant auxiliary power and 1 Amp of switched 24vdc power for door holders.
5. RNB shall include two (2) Class A or two (2) Class B control inputs for NAC or SOM connectivity. Two (2) N.C. dry contact trigger inputs shall also be provided.

6. RNB shall include four (4) Class A or four (4) Class B indicating circuits that are Class-2 power limited outputs rated at 2.5 Amps each, not to exceed to overall output rating of the given RNB series booster.
7. Two (2) Class B outputs may be paralleled for more power on an indicating circuit for any given RNB series booster.
8. The RNB shall support 2-wire horn/strobe sync mode that allows audible notification appliances (horns) to be silenced while visual notification appliances (strobes) continue to operate.
9. The RNB shall support audible/visual notification appliance sync protocols such as Gentex, System Sensor, Faraday, Wheelock and Amseco/Potter.
10. Short circuit and thermal overload protection, zero voltage drop upon transfer to battery backup, and built-in battery charger shall be included.
11. The RNB shall also include the following features:
  - a. Indicating Circuit Trouble Memory - facilitates quick location of intermittent system troubles and eliminates costly and unnecessary service calls. LEDs indicate that a prior fault (short, open, or ground) has occurred on one or more indicating circuit outputs.
  - b. Horn Patterns: Temporal Code 3, Steady, and March Time.
  - c. Input to Output Follower Mode (maintains synchronization throughout of indicating circuits)
  - d. Common trouble inputs and outputs, as well as ground fault detection shall be provided.
12. The RNB shall have the following LED indicators and relays:
  - a. System Fault LED
  - b. AC ON LED
  - c. DC ON LED
  - d. (4) NAC output LED
  - e. (2) FACP input LED
  - f. AC Fail relay (Form C)
  - g. DC Fail relay (Form C)

I. Auxiliary Power Supply (APS)

1. The APS shall be Hochiki America models FN-300, 400, 600, and 1024 series auxiliary power supply units. The APS outputs shall be rated 24VDC at 2.5, 4, 6, or 10 Amps respectively.
2. The terminal strips shall be UL listed for use with up to 12 AWG wire.
3. Short circuit and thermal overload protection, zero voltage drop upon transfer to battery backup, and built-in battery charger shall be included.
4. The APS units shall be used for auxiliary 24VDC power needs throughout the Hochiki FireNET system for addressable modules, expansion modules, accessories, annunciators, door holders, relays, indicators, etc.
5. The RNB shall have the following LED indicators and relays:
  - a. AC ON LED
  - b. DC ON LED
  - c. AC Fail relay (Form C)
  - d. Battery Low relay (Form C)
  - e. Battery Present relay (Form C)

J. Dialer (DACT)

1. The Digital Alarm Communicator Transmitter (DACT) is an interface for communicating digital information between a protected premise fire alarm control panel and a UL-Listed central station.
2. The DACT shall be Hochiki America model FN-DAC.
3. Two (2) reporting formats shall be supported: Contact ID and SIA.
4. The DACT shall report events by Zone or by Address (Point). Backup and Duplicate reporting shall be supported.
5. The DACT shall support up to (4) phone numbers and (4) accounts.
6. The DACT shall allow remote dial-in to the FireNET panel for programming and remote diagnostics.
7. The DACT shall have LED indicators for Power/Data, Telephone Line Active, and Remote Programming Active.
8. The input power shall be 24 VDC and may be supplied via the control panel or an auxiliary UL864/UL1481 listed power supply such as the Hochiki series of auxiliary power supplies and NAC boosters.
9. There shall be five different report groups that can be routed to one of four phone settings. These report groups consist of Alarm, Alarm Restore, Supervisory/Trouble/Enable/Disable, Service/Test, and System Reset. These report groups may be configured by using Loop Explorer configuration software.
10. The DACT shall include connections for dual telephone lines per UL and NFPA requirements. Phone lines shall be supervised.
11. For lightning and static suppression, the DACT shall include MOV and spark gap suppressors for the telephone line interface.

K. Graphix Software for PC (GUS)

1. The GUS shall be Hochiki America FireNET Graphix.
2. The GUS shall be capable of displaying information for all possible system points on a maximum size network of (64) nodes.
3. The GUS shall be capable of utilizing maps, photographs, text, audio, or a combination of these to display events from the fire alarm control panel network. Standard event messages may be customized as necessary.
4. The GUS shall record and store all events from the fire alarm control panel network. Event archive files shall be automatically created by the software. Event history can be filtered for viewing and exported as a text, .csv or HTML file.
5. A hardware security dongle shall be used to prevent unauthorized use of the software. The security dongle shall include a built-in RS232 – RS485 converter.
6. Up to eight additional workstations may be added to a GUS system, allowing for multiple user locations.
7. The GUS shall include a designer software program to create project files. The designer program shall utilize exported data from the fire alarm control panel network to obtain information about the installation. Devices may be added to maps by means of ‘drag and drop’ during the system design. Unlimited map linking shall be supported.
8. The GUS shall include a utility to convert .dwg and .dxf files to .bmp.
9. Up to 12 unique user log-in passcodes may be used. The system administrator may control the access of each user.

L. Voice Evacuation System (FNV)

1. The FNV shall be Hochiki America VoiceNET.

2. The FNV system shall include one Master Panel and one or more Distributed Panels. The system shall be microprocessor based, and shall be compatible for use with contact closures or serial data communication from the fire alarm control panel (FACP).
3. The FNV shall have a high-speed communication bus, with the capacity for six channels of combined audio and data on a single pair of wires. The communication bus circuit may be configured for either Style 4 or Style 7 supervision.
4. The FNV system shall have a minimum capacity of 2,048 monitor and control points.
5. The Master Panel shall contain an integral microphone, dual channel digital message repeater and digital tone generator, 120 VAC power supply and battery charger. The system shall be modular in design and shall be expandable such that additional system control points may be configured.
6. The system shall include internal self-diagnostic routines that continually monitor system status. The system shall indicate the precise type of trouble condition should one occur. A trouble condition within the system shall cause a trouble indication to be transmitted to the FACP.
7. Distributed panels shall provide a minimum of four Class "B" (Style Y) speaker circuits, expandable to eight total. Alternately, distributed panels may be configured for four Class "A" (Style Z) speaker circuits. Distributed panels will provide up to six simultaneous audio channels, and up to 16 Fire Phone circuits. Amplifiers shall contain their own power supplies and battery chargers, and provide auxiliary power for other components. Speaker circuits shall be supervised for short and open circuit conditions, and shall be able to withstand transient or continuous short-circuit conditions without damage to the system.
8. The FNV may be configured for General Alarm All-Call, Alarm by Zone, or Floor Above / Floor Below operation as required. Non-alarm areas may receive alert tones and messages as required or activated by the FACP. The alarm signal/evacuation message shall be broadcast until the FACP is reset, or until emergency personnel interrupt the broadcast with a manual page.
9. To prevent unauthorized tampering, the voice evacuation system shall disable the microphone if the microphone is keyed continuously for 3 minutes or more. Systems that do not have this feature shall not be acceptable.
10. All voice messages shall be contained in the Master Panel. Communication of all automatic and manual messaging and paging to the distributed panels shall be by means of a digital RS485 circuit. Low level (pre-amp) audio wiring shall not be permitted.
11. The FNV system shall be capable of supporting Fire Phone communications in addition to or in place of (stand-alone fire phone system) voice evacuation and manual paging. For systems supporting Voice Evacuation / Paging and Fire Phone Communications, operation of either function shall not restrict the operation of the other in any way (simultaneous operation).
12. Automatic triggering of voice evacuation / relocation functions shall be possible by means of RS232 Serial Interface as well as by bell circuit trip or contact closure by zone, and shall be programmable to evacuate by Fire Floor, Floor Above, Floor Below, or variations thereof.

M. Graphics LED Display (GLD)

1. The GLD shall be Hochiki America model FNP-LED.
2. The GLD shall be compatible with the FireNET Plus control panel.
3. The GLD shall be available in three standard sizes and in red or charcoal colors.
4. The GLD shall be available with or without controls and common indicators. Controls include buttons for RESET, ALARM SILENCE, LAMP TEST, and BUZZER SILENCE. Common indicators include Fire, Power On, Trouble, and Disablement.

5. The GLD shall utilize fiber optic light pipe to identify alarms and other events. Indicator positions may be added, moved or eliminated on the front panel display without wiring changes. Three standard enclosure sizes shall support from 24 to 88 indicators.
6. The GLD map shall utilize a field-replaceable Mylar overlay to accommodate project changes or tenant improvements.
7. Communication between the control panel and the GLD shall be by means of the FireNET Plus RS485 serial bus. The GLD shall require 24VDC power.
8. The GLD enclosure door lock shall use a CAT 30 key.
9. Systems that do not meet the FNP-LED performance criteria shall not be acceptable.

## 2.6. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

### A. Addressable Devices - General

1. Analog/Addressable devices shall be the following Hochiki America models:

ALK-V	Analog Photoelectric Detector (sensor)
ALG-V	Analog Photoelectric Detector (sensor)
AIE-EA	Analog Ionization Detector (sensor)
ATG-EA	Analog Heat/Thermal Detector (sensor)
DH-98A/R	Analog Photoelectric Duct Detector (sensor)
MS Series	Analog Duct Detector Accessories
STS Series	Analog Duct Detector Sampling Tubes
ASB	Addressable Sounder Base
HSB-NSA-6	Analog Detector Base (6")
YBN-NSA-4	Analog Detector Base (4")
AMS	Addressable Manual Pull-Station
FRCME-S/P/4	Addressable Single Input Module
FRCMA/-I	Addressable Single Input Module
DIMM	Addressable Dual Input Module
CZM	Addressable Conventional Zone Module
SOM	Addressable Supervised Output Module
SOM-A/-AI	Addressable Supervised Output Module
R2M	Addressable Dual Relay Output Module
R2ML/-I	Addressable Dual Relay Output Module
R2MH/-I	Addressable Dual Relay Output Module
SCI	Short Circuit Isolator Module
TCH-B100	Addressable Device Programmer

2. Addressable devices shall be simple to install and not require mechanical DIP or rotary address switches. Devices shall be digital and able to be addressed electronically via a hand held programmer.
3. Addressable devices, which use a mechanical address setting method, such as a DIP-switch, or decade dial (rotary) switches shall not be acceptable.
4. Addressable detectors/sensors shall be intelligent, analog, addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
5. Addressable detectors/sensors shall provide dual alarm and polling LED indicators. The indicators shall flash red under normal conditions, indicating that the detector/sensor is operational and in regular communication with the control panel. The indicators shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED indicator.

6. The fire alarm control panel shall permit addressable detector/sensor sensitivity adjustment through field programming of the system or by using the Hochiki Loop Explorer software. The panel on a time-of-day basis shall automatically adjust and alternate sensitivity between Day and Night modes.
7. The addressable detectors/sensors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance via intelligence and control from the panel per calibration and drift compensation functions. The detectors/sensors and control panel shall meet the calibrated sensitivity test requirements of NFPA Standard 72.
8. Addressable detectors/sensors shall include a separate twist-lock base. The bases shall permit direct interchange with the HOCHIKI America AIE-EA ionization type smoke sensor, ALG-V and ALK-V photoelectric smoke sensors, and the ATG-EA heat sensor. The vandal-resistant, security locking feature shall be used in those areas required by the application and implemented per the manufacturer's instructions. The locking feature shall be optional and can be implemented when required. Both 4-inch and 6-inch model electronics free bases shall be supported and shall be Hochiki America models YBN-NSA-4 and HSB-NSA-6 respectively.
9. Addressable detectors/sensors shall provide an integral test means whereby an internal fire test of the chamber or sensor shall be performed by the control panel automatically during each 24 hour calibration cycle. This operation shall guarantee every detector/sensor in the system is operational with each calibration cycle and any detectors/sensors that do not pass this test method shall indicate a trouble and maintenance alert on the control panel.
10. Addressable devices shall also store an internal identifying type code that the control panel shall use to identify the type of device specifically. The panel shall identify the exact type of detector/sensor, module, etc. Addressable devices of different types or variant models shall not use the same type code.
11. Addressable detectors/sensors shall operate in an analog fashion, where the detector measures its environment variable and transmits an analog value to the control panel based on real-time measured values of the ambient conditions. The control panel, not the detector/sensor, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector/sensor to be set and monitored by the control panel. The system operator shall have the ability to view the current analog value of each detector/sensor.
12. Addressable modules shall mount in a standard 4-inch square electrical construction box. Mini-Modules shall fit inside a standard 4-inch square or single-gang box.
13. Addressable devices shall be capable of accepting up to 14-gauge wire sizes.
14. Addressable devices shall be UL listed and compatible with the Hochiki America analog/addressable control panel employing Hochiki DCP Protocol, such as the FireNET Series.
15. Addressable device addresses shall be electrically programmable and stored in EEPROM.
16. Addressable device shall use Digital Communication Protocol (DCP) by Hochiki America which is noise immune and utilizes alarm interrupts for fast response to fires.
17. Addressable devices shall be programmed/addressed by using the Hochiki America model TCH-B100 Hand-held device programmer.
18. Addressable detectors, sensors, and modules shall operate on SLC addresses 1 - 127. Addressable sounder bases shall operate on SLC addresses 128-254. The SLC shall support 254 addresses total.

**B. Analog Photoelectric Smoke Detector - (ALK)**

1. The ALK analog photo smoke sensor shall have a UL listed operating range from 0.5%/ft. to 3.8%/ft. obscuration graduated across an air velocity range up to 4000 fpm.
2. Analog photo smoke sensors shall have a low profile design, only 1.97" high, including base.

3. Optical fire test feature shall be built-in.
4. The polling LED on the ALK smoke sensor shall be configurable to flash or not to flash when the sensor is polled by the control panel.
5. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.
6. The smoke chamber shall be removable to allow ease of maintenance and cleaning.

C. Analog Photoelectric Smoke Detector (ALG)

1. The ALG analog photo smoke sensors shall have a UL listed operating range from .88%/ft. to 3.57%/ft. obscuration graduated across an air velocity range up to 4000 fpm. Analog photo smoke sensors that do not support this minimum operating range or velocity capability shall not be acceptable.
2. Analog photo smoke sensors shall have a low profile design, only 1.97" high, including base.
3. Optical fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.
5. The smoke chamber shall be removable to allow ease of maintenance and cleaning.

D. Analog Ionization Smoke Detector (AIE)

1. Analog ion smoke sensors shall have a UL listed operating range from .55%/ft. to 1.15%/ft. obscuration.
2. Analog ion smoke sensors shall have a low profile design, only 2.22" high, including base.
3. Fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

E. Analog Thermal/Heat Detector - (ATG)

1. Analog heat sensors shall have a UL listed operating range from 135 to 150 degrees Fahrenheit when used as a fire detection device. The analog heat sensor shall support an increased operating range from 32 to 158 degrees Fahrenheit when used as a supervisory device.
2. Analog heat sensors shall have a low profile design, only 2.0" high, including base.
3. Fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

F. Multisensor - (ACA)

1. Analog Multi-Sensors shall utilize photoelectric smoke and heat detection in a combined unit.
2. Analog Multi-Sensors shall have a low profile design, 2.21" high including the base.
3. The analog Multi-Sensor may be operated in one of three different modes; Photoelectric Smoke Detection only, Heat Detection only, or Combined Smoke/Heat Detection.
4. The analog Multi-Sensor smoke sensor shall have a UL listed operating range from .88%/ft. to 3.57%/ft. obscuration graduated across an air velocity range up to 4000 fpm.
5. The analog Multi-Sensor heat sensor shall have a UL listed operating range from 135 to 150 degrees Fahrenheit when used in Heat Detection mode as a fire detection device. It shall support an increased operating range from 32 to 158 degrees Fahrenheit when used as a supervisory device.

6. The polling LED on the Multi-Sensor shall be configurable to flash or not flash when the sensor is polled by the control panel.
7. Fire test feature shall be built-in.
8. The Multi-Sensor plastic shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

G. Analog Photoelectric Duct Smoke Detector - (DH-98A/R)

1. Analog photo duct smoke sensors shall have a UL listed operating range from .88%/ft. to 2.75%/ft. obscuration across an air velocity range from 300 to 4000 fpm. Analog photo duct smoke sensors that do not support this operating range or velocity capability shall not be acceptable.
2. Optical Fire test feature shall be built-in.
3. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.
4. Analog photo duct smoke sensors shall include two (2) built-in programmable Form C relays, rated at 10 Amps @ 250VAC. An alternate non-relay two-wire model shall also be available that does not require 24VDC input power. The relay model operates on four-wires and requires 24VDC input power.
5. The duct detector housings shall be of metal construction and complete mechanical installation may be performed without removal of detector cover. The duct detector shall not require additional filters or screens which must be maintained. The housing shall contain a base which will accept an analog photoelectric duct sensor head. The housing cover shall be clear for easy inspection. Terminal connections shall be of the screw type and be a minimum of a #6 size screw. For installations requiring relay function (DH98-AR), terminals shall be provided for remote pilot, remote alarm indication, strobe/ horn and remote key switch. A manual reset switch shall be located on front of the device. For installations not requiring relay function (DH98A), visual indication of alarm and power must be provided.
6. The smoke chamber and head shall be removable to allow ease of maintenance and cleaning.

H. Addressable Sounder Base - (ASB)

1. The addressable sounder base shall be fully programmable and operate on an independent SLC address. The ASB shall not require extra control wiring, DIP switches, decade dial (rotary) switches, etc. to link multiple, independent sounder bases, or groups of sounder bases together. The ASB shall accommodate all analog sensors, such as photo, ion, or heat.
2. The addressable sounder base shall be UL listed as an indication device that provides 85 decibels of sound level output at 10 feet and shall have programmable audible patterns for temporal, continuous, or march time.
3. The ASB shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger sources for fire alarm, supervisory, and other logic to support hotel and high-rise apartment style applications, all from intelligent addressable output control from the panel.
4. The sounder base shall include support for a remote alarm LED indicator as an option.
5. The ASB shall be self addressing based on the host sensor address it is attached to, not requiring any special device address programming. The ASB shall automatically add 127 plus the detector address to obtain its independent address. The addressable sounder base shall operate in the higher SLC address range from 128 to 254. Systems which cannot automatically address the sounder base, sounder bases that are not fully programmable, or SLC that do not support 254 addresses shall not be accepted.

6. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

I. Addressable Manual Pull-Station - (AMS)

1. Manual pull stations shall be Hochiki addressable AMS-series single or dual action models, DCP-AMS, DCP-AMS-KL, DCP-AMS-LP, or DCP-AMS-KL-LP. Models shall be made of 14 AWG CRS and painted with Red enamel. The words Fire Alarm shall be in a contrasting color and be embossed text 1/2" tall. The electronics shall be fully integrated into the manual pull station requiring only connection to the SLC loop of the control panel. Programming of the manual pull station address must be possible with the manual pull station fully installed.
2. Manual pull stations shall be Underwriters Laboratories Inc. Listed, CSFM Approved, and be installed within the limits defined in the American Disabilities Act.
3. The AMS shall have the following features and options:
  - a. Addressable integrated design
  - b. All metal construction
  - c. Single and dual action models available
  - d. Extremely easy to operate
  - e. Bi-colored status LED indicates Standby and Alarm conditions
  - f. Address is programmable in EEPROM
  - g. Address can be programmed when installed
  - h. Key lock or hex key lock models available
  - i. Terminals accept up to 14AWG wire
  - j. Surface mount back box available
  - k. ADA compliant

J. Addressable Conventional Zone Module - (CZM)

1. Addressable Conventional Zone Module (CZM) shall provide one supervised IDC initiating zone for conventional alarm initiating devices and will connect to the SLC.
2. The CZM shall be suitable for Style D (Class A) or Style B (Class B) operation.
3. The CZM shall provide an address point for a conventional initiating zone (IDC) of up to (25) conventional smoke detectors depending on the model and brand. Conventional devices with a N.O. dry contact output may also be used and do not have a restriction of (25) devices. UL 2-wire compatibility is required on all conventional zone powered devices used on the IDC of the CZM module. Devices with N.O. dry contact output shall not require UL 2-wire compatibility.
4. The CZM shall have a bi-colored LED indicator that flashes green when polled and latches on red (controlled by panel) when activated for alarms.
5. The CZM shall require a 24VDC auxiliary power source to provide IDC power for the conventional zone of detectors.
6. The CZM shall at a minimum be compatible with Hochiki America models SLR, SIJ, SLK, SIH, DCD, and DFE series conventional detectors.

K. Addressable Dual Input Monitor Module - (DIMM)

1. The DIMM shall provide two (2) independently monitored inputs to connect N.O. dry contact type initiating devices to the SLC. Each input shall be capable of independent operation, such as one input for water-flow (Fire), and the other for valve tamper (Supervisory). The two inputs shall not interfere with each other or require common function and shall be capable of programmable operation, such as water-flow (Fire), valve tamper (Supervisory), manual pull-station (Fire), and other general event categories.
2. The DIMM shall only occupy one (1) SLC address. The two (2) inputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using DIMM shall be capable of (254) inputs when all (127) SLC addresses are used.
3. The DIMM shall operate on Style 4, 6, or 7 SLC. The inputs shall be capable of being programmed for N.O. or N.C contacts, with an option for non-supervised N.C. (no EOL) operation.
4. The DIMM shall have a bi-colored LED indicator for displaying device polling and alarm status.

L. Addressable Single Input/Mini Monitor Modules - (FRCME-4/S/P)

1. Addressable single input modules (FRCME) shall provide a monitored input to connect N.O. dry contact type initiating devices to the SLC. The input shall be capable of programmable operation, such as water-flow (Fire), valve tamper (Supervisory), manual pull-station (Fire), and other general event categories.
2. The FRCME shall operate on Style 4, 6, or 7 SLC. The input shall be capable of being programmed for a N.O. or N.C contact, with an option for non-supervised N.C. (no EOL) operation.
3. The FRCME-4 shall have a bi-colored LED indicator for displaying device polling and alarm status.

M. Addressable Single Input Monitor Modules - (FRCMA / -AI)

1. Addressable single input modules (FRCMA) shall provide a monitored input to connect N.O. dry contact-type initiating devices to the SLC. The input shall be capable of programmable operation, such as water-flow (Fire), valve tamper (Supervisory), manual pull station (Fire), and other general event categories.
2. The FRCMA module shall support one NFPA Class A (Style D) circuit or one Class B (Style B) circuit.
3. The FRCMA shall operate on Style 4, 6, or 7 SLC. The input shall be capable of monitoring N.O. contacts in Class A mode, and N.O. or N.C. contacts when in Class B mode.
4. The FRCMA shall have a bi-colored LED indicator for displaying device polling and alarm status.
5. The FRCMA-I shall contain built-in Short Circuit Isolator circuitry (SCI). A yellow LED shall illuminate to indicate when the SCI is activated.

N. Addressable Supervised Output Module - (SOM)

1. The SOM shall provide supervision and controlled activation of polarized 24VDC audio/visual notification appliances and other 24VDC powered devices.
2. The SOM shall provide a voltage output rated at 24VDC @ 2.0 Amps. The output shall be wired for Style Y (Class B) operation. The output shall provide reverse polarity operation for supervision of the device circuit. Outputs patterns shall be Temporal, Continuous, and March. There shall be a silence-able option.

3. Audio/visual load power for the SOM shall be provided by a separate supervised 24VDC auxiliary power circuit from the control panel or from a Hochiki APS auxiliary power supply or RNB remote NAC booster unit as described elsewhere in this document.
  4. The SOM shall be suitable for remote supervision and control activation of Hochiki RNB remote NAC booster units.
  5. The SOM shall have 16 different control states and modulation patterns for multi-state programming. The operating parameters for the SOM shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the SOM or group of SOMs will respond based on individual programming allowing simultaneous group device activations from a single control panel command. Systems that do not meet this requirement shall not be acceptable.
  6. The SOM shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support hotel and high-rise apartment style applications, all from intelligent addressable output control from the panel.
  7. The SOM shall have a bi-colored LED indicator for displaying device polling and control status.
  8. Systems that do not meet the SOM performance criteria shall not be acceptable.
- O. Addressable Supervised Output Module - (SOM-A / SOM-AI)
1. The SOM-A / SOM-AI shall provide supervision and controlled activation of polarized 24VDC audio/visual notification appliances and other 24VDC powered devices.
  2. The SOM-A / SOM-AI shall provide a voltage output rated at 24VDC @ 2.0 Amps. The output may be configured as a single Style Y (Class B) circuit, or it may be configured as a single Style Z (Class A) circuit. The output shall provide reverse polarity operation for supervision of the device circuit. Outputs patterns shall be Temporal, Continuous, and March. There shall be a silence-able option.
  3. Audio/visual load power for the SOM-A / SOM-AI shall be provided by a separate supervised 24VDC auxiliary power circuit from the control panel or from a Hochiki APS auxiliary power supply or RNB remote NAC booster unit as described elsewhere in this document.
  4. The SOM-A / SOM-AI shall be suitable for remote supervision and control activation of Hochiki RNB remote NAC booster units.
  5. The SOM-A / SOM-AI shall have 16 different control states and modulation patterns for multi-state programming. The operating parameters for the module shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the SOM-A / -AI module(s) will respond based on individual programming allowing simultaneous group device activations from a single control panel command. Systems that do not meet this requirement shall not be acceptable.
  6. The SOM-A / SOM-AI shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support hotel and high-rise apartment style applications, all from intelligent addressable output control from the panel.
  7. The SOM-A / SOM-AI shall have a bi-colored LED indicator for displaying device polling and control status.
  8. The SOM-AI shall be equipped with built-in SLC short circuit isolation circuitry (SCI).

9. Systems that do not meet the SOM-A / SOM-AI performance criteria shall not be acceptable.

P. Addressable Dual Relay Module - (R2M)

1. The R2M shall provide two (2) independently controlled relay outputs to connect devices requiring control from the fire system to the SLC. Each output shall be capable of independent operation. The two outputs shall not interfere with each other or require common function and shall be capable of programmable operation such as general event categories, zone control, point control, silence-able option, two output delay options, and Cause & Effect logic control.
2. The R2M shall only occupy one (1) SLC address. The two (2) outputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using R2M shall be capable of (254) outputs when all (127) SLC addresses are used.
3. The R2M shall operate on Style 4, 6, or 7 SLC. The outputs shall be two (2) Form C relay contacts rated at .5 Amps @ 125VAC or 1 Amp 30VDC. The R2M shall not require a 24VDC auxiliary power supply source.
4. The R2M shall have 16 different control states for multi-state programming. The operating parameters for the R2M shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the R2M or group of R2Ms will respond based on individual programming allowing simultaneous group device activations from a single control panel command. The R2M shall also have the ability to receive individual commands (non-group commands) from the control panel along with the group command broadcasts. Systems that do not meet this requirement shall not be acceptable.
5. The R2M shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support elevator recall, fan/damper control, door holder/lock control, and other building control functions, all from intelligent addressable output control from the panel.
6. The R2M shall have a bi-colored LED indicator for displaying device polling and control status.
7. Systems that do not meet the R2M performance criteria shall not be acceptable.

Q. Addressable Dual Relay Module - (R2ML / R2ML-I)

1. The R2ML / R2ML-I shall provide two (2) independently controlled relay outputs to connect devices requiring control from the fire system to the SLC. Each output shall be capable of independent operation. The two outputs shall not interfere with each other or require common function and shall be capable of programmable operation such as general event categories, zone control, point control, silence-able option, two output delay options, and Cause & Effect logic control.
2. The R2ML / R2ML-I shall only occupy one (1) SLC address. The two (2) outputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using R2ML / R2ML-I modules shall be capable of (254) outputs when all (127) SLC addresses are used.
3. The R2ML / R2ML-I shall operate on Style 4, 6, or 7 SLC. The outputs shall be two (2) Form C relay contacts rated at .5 Amps @ 120VAC or 2 Amps @ 30VDC. The module shall not require a 24VDC auxiliary power supply source.

4. The R2ML / R2ML-I shall have 16 different control states for multi-state programming. The operating parameters shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the R2ML / R2ML-I module(s) will respond based on individual programming allowing simultaneous group device activations from a single control panel command. The module shall also have the ability to receive individual commands (non-group commands) from the control panel along with the group command broadcasts. Systems that do not meet this requirement shall not be acceptable.
5. The R2ML / R2ML-I shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support elevator recall, fan/damper control, door holder/lock control, and other building control functions, all from intelligent addressable output control from the panel.
6. The R2ML / R2ML-I shall have a bi-colored LED indicator for displaying device polling and control status.
7. The R2ML-I shall be equipped with built-in SLC short circuit isolation circuitry (SCI).
8. Systems that do not meet the R2ML / R2ML-I performance criteria shall not be acceptable.

R. Addressable Dual Relay Module - (R2MH / R2MH-I)

1. The R2MH / R2MH-I shall provide two (2) independently controlled relay outputs to connect devices requiring control from the fire system to the SLC. Each output shall be capable of independent operation. The two outputs shall not interfere with each other or require common function and shall be capable of programmable operation such as general event categories, zone control, point control, silence-able option, two output delay options, and Cause & Effect logic control.
2. The R2MH / R2MH-I shall only occupy one (1) SLC address. The two (2) outputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using R2MH / R2MH-I modules shall be capable of (254) outputs when all (127) SLC addresses are used.
3. The R2MH / R2MH-I shall operate on Style 4, 6, or 7 SLC. The outputs shall be two (2) Form C relay contacts rated at 4.8 Amps @ 250VAC or 8 Amps @ 30VDC. The module shall not require a 24VDC auxiliary power supply source.
4. The R2MH / R2MH-I shall have 16 different control states for multi-state programming. The operating parameters shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the R2MH / R2MH-I module(s) will respond based on individual programming allowing simultaneous group device activations from a single control panel command. The module shall also have the ability to receive individual commands (non-group commands) from the control panel along with the group command broadcasts. Systems that do not meet this requirement shall not be acceptable.
5. The R2MH / R2MH-I shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support elevator recall, fan/damper control, door holder/lock control, and other building control functions, all from intelligent addressable output control from the panel.
6. The R2MH / R2MH-I shall have a bi-colored LED indicator for displaying device polling and control status.
7. The R2MH-I shall be equipped with built-in SLC short circuit isolation circuitry (SCI).
8. Systems that do not meet the R2MH / R2MH-I performance criteria shall not be acceptable.

S. Short Circuit Isolator Module - (SCI)

1. The SCI shall provide automatic isolation of wire-to-wire short circuits on a Class A (Style 6 or 7) SLC or Class B (Style 4) SLC trunk and/or branch circuits. The isolator module shall prevent addressable devices from being rendered inoperative by a short circuit fault on the SLC when used in a NFPA 72 Style 7 configuration. When used in Style 4 or 6 hybrid configurations (i.e. not fully Style 7 compliant), the isolator module shall limit the number of addressable devices from being rendered inoperative by a short circuit fault on the SLC.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the segment of the SLC that is shorted. When the short circuit condition is corrected, the SCI shall automatically reconnect the isolated segment.
3. The SCI shall not require address-setting or an SLC address. The SCI operation shall be completely automatic. It shall not be necessary to replace or reset an SCI after its normal operation. The SCI shall have the ability to be placed anywhere on the SLC and shall not have a limit of how many can be placed on a given SLC.
4. The SCI shall provide a single yellow LED that shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.7. SYSTEM COMPONENTS - OTHER DEVICES

A. Audible/Visual Notification Appliances

Audible/visual notification appliances shall meet the applicable requirements of UL464 and UL1971 respectively, and shall be compliant with NFPA72 & ADA guidelines accordingly. All A/V notification appliances shall be UL listed as compatible with the Hochiki America FireNET series control panels and identified by UL per the control panel installation manual. The following A/V notification appliances manufacturers shall be acceptable:

Amseco/Potter  
Gentex  
Wheelock  
Hochiki America

B. Conventional Devices

Conventional fire alarm devices, if applicable, shall be the following Hochiki America models:

SLR/SLV Series	Photoelectric Smoke Detectors
SIJ Series	Ionization Smoke Detectors
DFE Series	Heat Detectors (fixed temp)
DCD Series	Heat Detectors (fixed temp & rate-of-rise)
DSC Series	Heat Detectors (rate-of-rise)
HF Series	Flame Detectors (UV)
SPB/SPC Series	Beam Detectors
SRA Series	Beam Detectors (reflective)
DH98 Series	Duct Detectors (conventional)
MS Series	Duct Detector Accessories
STS Series	Duct Detector Sampling Tubes
HPS Series	Manual Pull-Stations
MP/MG Series	Manual Pull-Stations
NS6 Series	Detector Bases (6")
NS4 Series	Detector Bases (4")
HSC Series	Detector Bases (4-wire)
HSC-L Series	Heat Detector Bases (w/LED)

HSC-R Series	Relay Bases
SBC Series	Sounder Bases
HCP Series	Control Panels (conventional)

D. Test Equipment

Fire alarm test equipment, if applicable, shall be the following Hochiki America models:

TRT Series	Smoke Detector Tester/Removal Tool
NSRT Series	Smoke Detector Removal Tool
NSTT Series	Smoke Detector Tester Tool
TSC Series	Metal Holder Tool
NSTP Series	Pole Extension/Adapter
TSE Series	Smoke Detector Tester Pole
TCH Series	Hand-held Programmer and Tester

E. Door Holders

Door holders, if applicable, shall be Hochiki America model DH24 Series.

F. End-Of-Line Relays

Power supervision End-Of-Line Relays, if applicable, shall be Hochiki America model HA-EOLR.

F. Water-flow Indicators (Fire)

1. Water-flow switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Water-flow switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 90 seconds. Initial settings are recommended at 30-45 seconds. The water-flow switches and installation, along with initial retard delay action and settings, shall comply with UL864 9th Edition, UL346, NFPA72, NFPA13, local codes, and AHJ, as applicable.
3. All water-flow switches shall come from a single manufacturer and series. The electrical properties of the flow switch output shall be a N.O. dry contact (when in normal non-water-flow condition) rated at a minimum of 1 Amp resistive.
4. Water-flow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate water-flow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.
6. Water-flow switches shall be monitored by Hochiki America models FRCM series and/or DIMM input monitor modules.

G. Sprinkler and Standpipe Valve Position Switches (Supervisory)

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a valve position supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a valve position supervisory switch.

3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position. The valve position supervisory switches and installation shall comply with UL864 9th Edition, NFPA72, NFPA13, local codes, and AHJ, as applicable.
4. All valve position supervisory switches shall come from a single manufacturer and series. The electrical properties of the valve monitor switch output shall be a N.O. dry contact (contact is open when the valve is not in the bypass position and regular water-flow is enabled) rated at a minimum of 1 Amp resistive.
5. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
6. The switch housing shall be finished in red baked enamel.
7. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
8. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.
9. Where possible, locate valve position supervisory switches a minimum of three (3) feet from the valve.
10. Valve position supervisory switches shall be monitored by Hochiki America models FRCM series and/or DIMM input monitor modules.

## 2.8. BATTERIES

- A. The fire system standby batteries shall have sufficient capacity to provide power to the fire alarm system for not less than twenty-four (24) hours in standby and five (5) minutes of alarm upon a failure of normal AC power and shall comply with UL864 9th Edition and NFPA72 criteria.
- B. Batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. Battery sizes up to 60AH shall be acceptable and sized per fire alarm system demands and capacities of the individual control panels, network nodes, NAC boosters, auxiliary power supplies, and/or external battery chargers and supplies.
- D. If necessary to meet standby requirements system wide, external battery and charger systems may be used. All power supplies and chargers must comply with UL864 9th Edition and/or UL1481 standards, as applicable.
- E. All loading for batteries, standby power, and alarm power for the fire alarm system shall be calculated and provided for compliance to this specification. Appropriate battery calculators for applicable control panels, network nodes, NAC boosters, auxiliary power supplies, external battery chargers and supplies, and/or other power sources shall be included with this submittal.

## PART 3.0 - EXECUTION

### 3.1. INSTALLATION

- A. Installation shall be in accordance with the Codes and Standards outlined earlier in this specification, as well as with all local and state codes, per AHJ requirements, as shown on the drawings, and as recommended by the equipment manufacturer.

- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system commissioning, programming, and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage, including using the manufacturer's device dust covers.
- C. All fire detection and system devices, control panels, network nodes, remote annunciators, etc. shall be flush mounted where possible when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual pull-stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor. Manual pull-station installation shall comply with ADA requirements and all local building codes.

### 3.2. TEST

The service of a competent, factory-certified/trained engineer or technician authorized by Hochiki America for the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system, during initial commissioning, as well as with post installation service and maintenance testing, as applicable. All testing shall be in accordance with NFPA 72.

- A. Before energizing the system, cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation failures.
- B. Close each sprinkler system monitor valve and verify proper supervisory operation at the control panel.
- C. Verify activation of all water-flow switches and verify proper fire alarm operation at the control panel.
- D. Verify all trouble signals for SLC, NAC, system network, system devices and accessories to ensure proper trouble signal actuation and operation.
- E. Verify operation of system ground fault detection to ensure proper trouble operation and to prove the fire alarm system is clear of all grounds.
- F. Check all notification appliance device operation by performing fire drill tests. Verify proper audibility, synchronization, and tone patterns. Check and confirm proper strobe operation, synchronization, and light intensity. Audible/visual notification appliance installation and operation shall comply with UL864 9th Edition, UL464, UL1971, NFPA72, local codes, and AHJ requirements.
- G. Check installation, supervision, and operation of all alarm zones using the walk test function.
- H. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the control panel and the correct activation of the control points. The system sequence of operations and logic supplied with the submittal of the fire alarm system per this specification and as required by the local plan check division of the AHJ, shall be tested and verified during final commissioning of the system.

- I. When the system is equipped with optional features, the manufacturer's documentation shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar. In general, test methods shall comply with the manufacturer's instructions and recommendations for the equipment under this specification.

### 3.3. FINAL INSPECTION

- A. At the final inspection, a Hochiki factory-certified/trained representative for the equipment shall demonstrate that the system functions properly in every respect.
- B. The system shall be demonstrated satisfactorily and comply with local AHJ requirements for Temporary Certificate of Occupancy (T.C.O.) and/or Permanent Certificate of Occupancy (C.O.).
- C. The final inspection performance and documentation shall comply with local AHJ and NFPA72 requirements.
- D. System operating instructions placard or signage shall be installed at AHJ designated locations for the control panels and annunciators in the system per UL864 9th Edition and NFPA72. The manufacturers system operating instructions shall be used for this purpose.
- E. As-built drawings and programming shall be provided upon completion.

### 3.4. INSTRUCTION

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."
- C. Appropriate quantities of installation and operation manuals shall be provided and used for instructional purposes.

End of Section