

# **UCDAVIS HEALTH**

**FACILITIES DESIGN & CONSTRUCTION  
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## **SESP 1P752-1P758 X-Ray Replacement 9557580**

### **Project Manual**

**Delta 1 – HCAI Backcheck Response 1  
HCAI No.: S231373-34-00**

#### **HGA**

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**8 November 2023**

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DOCUMENT 000105  
CERTIFICATIONS PAGE

**ARCHITECTURAL**



**STRUCTURAL**



**MECHANICAL**



**ELECTRICAL**



END OF DOCUMENT



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## SECTION 011100

### SUMMARY OF THE WORK

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Description of the Work
- B. Contractor Warrants
- C. Contract Document Intent and Relationships
- D. University Furnished/Contractor Installed Products
- E. University Furnished/University Installed Products
- F. Concurrent Work Under Separate Contracts
- G. Site Condition Survey and Protection of Existing Improvements
- H. Contractor Use of Site and Premises
- I. University Beneficial Occupancy (if applicable)
- J. Project Phasing (if applicable)

##### 1.02 DESCRIPTION OF THE WORK

- A. Project is titled: UCDH SESP RAD ROOMS 1P752, 1P754, 1P758 EQUIPMENT REPLACEMENT
- B. University Project No.: M052387
- C. Project is located at 2315 Stockton Boulevard, Sacramento, CA 95817, UC Davis Health, Sacramento, California, as shown on the vicinity map.
- D. This project consists of radiological equipment replace in 3 X-ray rooms at the UCDH SESP building. Existing X-Ray equipment will be replaced with similar new equipment utilizing the existing structural support system. Existing cabinets with Hand-wash sink in each room does not meet accessibility requirements and will be removed and replaced with new cabinetry and hand-wash sink. Per the medical physicist report the existing lead shielding is sufficient for the new equipment. Areas of shielding disturbed during construction shall be replaced with shielding to match existing. The control area modular shielding in room 1P754 will be removed and replaced in a new configuration to provide better shielding of the existing wall opening facing the staff areas of the radiology dept. Minor cosmetic changes such as painting and installing new wall protection is also included in the scope of this project. No proposed changes to the existing rated walls or smoke compartments.
- E. The X-ray room construction will be phased. Each room will be completed sequentially such that 2 rooms are always operational. Room 1P758 shall be completed first, followed

by room 1P754, then by room 1P752. Phasing of construction shall be coordinated confirmed with the UCDH Radiology dept. at the time of construction.

- F. Build-out as shown and herein specified, complete and ready for occupancy, the following renovated facility shown on the Contract Documents.
- G. Special Constraints and Criteria:
  - 1. Refer to Section 011400 Work Restrictions for dates and hours when the building is occupied and operational, and work-shift hour requirements and restrictions.
  - 2. Noise Mitigation shall be required when the building is occupied.
  - 3. Egress shall not be restricted or impacted unless scheduled when the building is not occupied.

### 1.03 CONTRACTOR WARRANTIES

- A. Contractor warrants that it is skilled and experienced in the use and interpretation of Contract Documents such as those included in the bid documents for this Contract. The **[Contractor]** further warrants that it has carefully reviewed the Contract Documents for this Work and has found them to be free of ambiguities and sufficient for bid purposes.
- B. Contractor warrants that it has inspected the Project Site and based on these observations, has satisfied itself as to the nature and location of the Work; and any special conditions likely to be encountered at the site which may affect the performance of the Work.
- C. Contractor warrants that its bid is based solely on the Contract Documents provided, its own observations, and written explanations and interpretations obtained from University's Representative and not on any explanation or interpretation, oral or written, from any other source.

### 1.04 CONTRACT DOCUMENT INTENT AND RELATIONSHIPS

- A. Contract Documents Intent: Provide all labor, material, equipment, tools, transportation, insurance, services, and all other requirements necessary to construct the project described in the Contract Documents.
- B. Relationship of Contract Documents: Drawings, Specifications and other Contract Documents in the Contract are intended to be complementary. What is required by one shall be as if required by all. What is shown or required, or may be reasonably inferred to be required, or which is usually and customarily provided for similar work, shall be included in the Work. For example, the drawings may not show every variation of an anchor clip that is required to support a curtain wall from its structural support; it can be reasonably inferred that variations of or additions to these clips are necessary to complete the installation of the working system and therefore all such clips are understood to be included in the Work.

- C. Discrepancies in Contract Documents: In the event of error, omission, ambiguity, or conflict in the Contract Documents, Contractor shall bring the matter to University's Representative's attention in a timely manner, for University's Consultant's determination and direction in accordance with provisions of the General Conditions of the Contract.
- D. Bidding and Contract requirements: Information for bidding, Conditions of the Contract and other Contract documents will be produced by University and may be included in the Contract Documents for convenience. Such documents are not Specifications. Specifications are found in Divisions 1 through 48 of the Contract, as listed in the Table of Contents of the Contract.
- E. Contract Drawings: The Drawings provided with and identified in the Contract are the Drawings referenced in the Agreement.
  - 1. Drawings produced for this project may encompass Civil, Landscape, Architectural, Structural, HVAC, Plumbing, Piping, Fire Protection, and Electrical portions of the Work. Interior Design drawings may also be provided for product selection and installation information.
  - 2. The location, extent and configuration of the required construction and improvements are shown and noted on the Drawings. A list of Drawings is included in the Contract Documents.
  - 3. Drawings are arranged according to design discipline. Such organization and all references to trades, subcontractor, specialty contractor or supplier shall not control the Contractor in dividing the work among subcontractors or in establishing the extent of the work to be performed by any trade.
  - 4. Where the terms "as shown", "as indicated", "as noted", "as detailed", "as scheduled" or terms of like meaning, are used in the Drawings or Specifications, it shall be understood that reference is being made to the List of Drawings and the Specifications as bound in the Contract Documents.
  - 5. Where reference to the word "plans" is made anywhere in the Drawings, Specifications and related Contract Documents, it shall be understood to mean the Drawings listed in the List of Drawings.
- F. Contract Specifications: The Specifications provided as a part of the Contract Documents are the Specifications referenced in the Agreement.
  - 1. The Specifications are organized by Division and Sections in accordance with recommended practice of the Construction Specifications Institute. Such organization shall not control the Contractor in dividing the work among subcontractors or in establishing the extent of the work to be performed by any trade.
  - 2. Specifications are included in the Contract, which also includes other Bidding and Contract Documents. Contents of the Contract are listed in the TABLE OF CONTENTS.
  - 3. Information for bidding, Conditions of the Contract and other Contract documents will be produced by University. Such documents are not Specifications. Specifications are found in Division 1 through 48 of the Contract.

1.05 UNIVERSITY-FURNISHED, CONTRACTOR-INSTALLED (UFICI) PRODUCTS

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- A. University-Furnished Products: University will furnish, for installation by Contractor, products which may be identified on the Drawing and in the Specifications as UFCI (University-Furnished/Contractor-Installed).
  - 1. Lead Apron Hanger - UFCI, backing support by contractor.
  - 2. Tall double supply cabinet - UFCI, anti tip wall connection by contractor.
  - 3. X-ray equipment furnished by the university and installed by vendor and contractor.
  
- B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to fully incorporate such products into the Work, including, as necessary but not limited to: fasteners, backing, supports, piping, conduit, conductors, and other such provisions from point of service to point of connection, and field finishing, as shown on the Drawings and/or Specified herein. See Section 013100 - COORDINATION for additional requirements.

#### 1.06 UNIVERSITY-FURNISHED, UNIVERSITY-INSTALLED (UFUI) PRODUCTS

- A. University-Furnished Products: University will furnish and install products which may be identified on the Drawing and in the Specifications as UFUI (University-Furnished/University-Installed).
  - 1. Imaging and X-Ray Equipment will be furnished by the University.
  - 2. [ List specific products to be furnished and installed by the University ].
  
- B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to provide all rough-in requirements into the Work, including as necessary but not limited to fasteners, backing, supports, piping, conduit, conductors and other such provisions from point of service to point of connection, and field finishing, as shown on the Drawings and/or specified herein. See Section 013100 - COORDINATION for additional requirements.

#### 1.07 CONCURRENT WORK UNDER SEPARATE CONTRACTS

Use this sub-Section only when conducting the build-out with separate contractors, such as Multiple Primes. Other examples of situations requiring this approach: Plant Operations & Maintenance (PO&M) to install casework they have built. IT department to install cabling, panelboards, etc. for its systems during the construction period.

- A. Work Under Separate Contracts: University will award separate contracts for the following work and other work as may be indicated on the Drawings as NIC (Not in Contract), including the following:
  - 1. Test and balance work.
  - 2. HVAC digital control work.
  - 3. [List specific work by others.]

- B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to make such concurrent work under separate contracts complete in every respect and fully functional, including field finishing. Provide necessary backing, supports, piping, conduit, conductors, and other such provisions from point of service to point of connection for additional requirements.
- C. Related Contract Documents: University will make available, in a timely manner, Contract Documents of work under separate contracts for coordination and further description of that work. Such drawings and other data required for the coordination of the work of separate contracts with the Work of this Contract may be included with the Contract Documents. If so, they are provided for convenience only and are not to be considered Contract Documents.

#### 1.08 SITE CONDITION SURVEY & PROTECTION OF EXISTING IMPROVEMENTS

- A. Site Condition Survey: Prior to commencing work, the Contractor, University's Representative and other University representatives shall tour the Project site together to examine and record the existing condition of site, adjacent buildings, and improvements. This record shall serve as a basis for determination of damage (if any) due to the construction process. The record shall be signed by all parties participating in the tour.
- B. Protection of Existing Improvements: Locate all known existing utilities prior to proceeding with construction. Existing utilities shall be kept in service where possible and protected by the Contractor from damage. If any structure or utility is damaged, take immediate action to ensure the safety of persons and University property and effect repair. If previously undiscovered structures or utilities are encountered, request University's Representative to provide direction on how to proceed with the work. Cracks, sags or damage to adjacent structures or improvements not noted in the original survey shall be reported to University's Representative.
- C. University does not normally charge for its shutdown support services. However, if poor planning or execution of a shutdown by Contractor causes excessive time and effort for University, University reserves the right to back charge Contractor for additional work.

#### 1.09 CONTRACTOR USE OF SITE AND PREMISES

- A. Site Access: Limit access to site as indicated on the drawings. If routes and access points are not indicated, access shall be as directed or approved by University's Representative.
- B. Construction Limit: Limit construction activities to areas indicated on Drawings as Project Area or, if not indicated, to areas immediately adjacent to buildings and as necessary for immediate construction or utility services and sitework, See Section 015100 - TEMPORARY UTILITIES for additional requirements.
- C. Utility Outages and Shutdowns: Schedule utility outages and shutdowns to times and dates acceptable to University's Representative. Duration of outages and shutdowns shall not hinder University normal business operations. Provide fourteen (14) calendar days' notice of all utility outages and shutdowns.

#### 1.10 UNIVERSITY BENEFICIAL OCCUPANCY [Use as applicable]

Use only to identify space(s) the University must occupy prior to completion of the entire project.

- A. The following portions of the Work are designated for occupancy by University as indicated.
  - 1. [Insert text as appropriate] [Provide complete list of rooms or areas to which Beneficial Occupancy applies].

1.11 PROJECT PHASING

- A. The WORK OF THIS contract is divided into 3 Phases.
  - 1. Overall Duration: 462 calendar days, with milestones per below
    - Phase 1 - 150 calendar days
    - 21 calendar day duration between Phases 1 and 2
    - Phase 2 - 120 calendar days
    - 21 calendar days between Phases 2 and 3
    - Phase 3 - 120 calendar days
    - Closeout - 30 calendar days

**PART 2 PRODUCTS – Not Applicable to this Section**

**PART 3 EXECUTION – Not applicable to this Section**

**END OF SECTION 011100**

**SECTION 011400**  
**WORK RESTRICTIONS**

1.1 - GENERAL

1.2 WORK HOURS

NOTE TO PM, INSTRUCTIONS FOR WORK HOURS:

USE PARAGRAPH A FOR PROJECTS WITH WORK HOURS RESTRICTED TO 7 A.M. TO 5 P.M. AND DELETE PARAGRAPH B.

USE PARAGRAPH B FOR PROJECTS THAT REQUIRE AN ACCELERATED SCHEDULE TO COMPLETE THE WORK WITHIN THE CONTRACT TIME, OR FOR AREAS THAT REQUIRE EARLY OCCUPANCY.

IF PARAGRAPH B IS USED, DELETE TEXT IN PARAGRAPH A AND REPLACE WITH TEXT IN PARAGRAPH B.

DELETE INSTRUCTIONS AFTER EDITING.

1.3 NO WORK SHALL BE DONE OUTSIDE OF STANDARD MONDAY THROUGH FRIDAY 7:00 A.M. TO 5:00 P.M. WORKING HOURS, ON HOLIDAYS OR WEEKENDS UNLESS PRIOR WRITTEN APPROVAL HAS BEEN RETAINED FROM THE UNIVERSITY'S REPRESENTATIVE.

1.4 WORK SHIFTS AND WORK DURING HOLIDAYS AND WEEKENDS. (OMIT IF PARAGRAPH A IS USED)

- A. The CONTRACTOR shall provide two work shifts 7:00 a.m. to 5:00 p.m. and 7:00 p.m. to 5:00 a.m. Each work shift shall use a different Superintendent at no additional cost to the University.
- B. The CONTRACTOR shall work Holidays and Weekends at no additional cost to the University.

1.5 PROJECT PHASING (EDIT OR INDICATE NOT USED)

NOTE TO PM, INSTRUCTIONS FOR PROJECT PHASING:

PM TO EDIT AND IDENTIFY PHASES. THE PM SHALL REVIEW THE CONTRACT FOR THE **[CONTRACTOR][CM/CONTRACTOR][DESIGN-BUILDER]** TO IDENTIFY PROJECT PHASES AND DURATIONS; LIST PHASES AS WELL AS INDICATE PREDECESSOR AND RESTRICTIONS THAT NEED TO BE COMPLETED PRIOR TO THE START OF THE NEXT PHASE.

USE WORK SEQUENCE AND WORK RESTRICTIONS IF THERE ARE NO PHASES IDENTIFIED IN THE CONTRACT.

DELETE INSTRUCTIONS AFTER EDITING.

1.6 CONTRACTOR'S USE OF PROJECT SITE

1.7 CONTRACTOR'S USE OF THE PROJECT SITE FOR THE WORK AND STORAGE IS RESTRICTED TO THE AREAS DESIGNATED ON THE DRAWINGS.

1.8 SUBSTANTIAL COMPLETION

1.9 SUBSTANTIAL COMPLETION SHALL BE APPLICABLE TO THE ENTIRE WORK.

1.10 PROTECTION OF PERSONNEL

1.11 PATIENTS, UNIVERSITY OF CALIFORNIA DAVIS (UCD) PERSONNEL AND STUDENTS, WILL BE OCCUPYING PARTS OF THE ADJACENT BUILDINGS DURING THE CONSTRUCTION PERIOD. CONTRACTOR SHALL TAKE PROPER PRECAUTIONS TO ENSURE THE SAFETY OF ALL PERSONS DURING THE CONSTRUCTION PERIOD.

1.12 WORK SITE DECORUM

1.13 EXTREME CARE TO LIMIT NOISE SHALL BE TAKEN AT ALL TIMES THAT THE BUILDING IS OCCUPIED. LOUD OR UNNECESSARY CONVERSATION SHALL BE AVOIDED. THE PLAYING OF RADIOS, OR ANY AUDIO DEVICES SHALL BE STRICTLY PROHIBITED. NOISE, THAT IN THE SOLE OPINION OF THE UNIVERSITY'S REPRESENTATIVE, IS DISTURBING OR DISRUPTIVE TO OCCUPANTS OF THE BUILDING SHALL BE SCHEDULED FOR PERIODS WHEN THE BUILDING IS NOT OCCUPIED.

1.14 CONTRACTOR SHALL CONTROL THE CONDUCT OF ITS EMPLOYEES SO AS TO PREVENT UNWANTED INTERACTION INITIATED BY CONTRACTOR'S EMPLOYEES WITH UCD STAFF, PATIENTS, STUDENTS OR OTHER INDIVIDUALS, ADJACENT TO THE PROJECT SITE. WITHOUT LIMITATION, UNWANTED INTERACTION BY CONTRACTOR'S EMPLOYEES INCLUDES WHISTLING AT OR INITIATING CONVERSATIONS WITH PASSERSBY. IN THE EVENT THAT ANY CONTRACTOR'S EMPLOYEE INITIATES SUCH UNWANTED INTERACTION, OR UTILIZES PROFANITY, CONTRACTOR SHALL, EITHER UPON REQUEST OF UNIVERSITY'S REPRESENTATIVE OR ON ITS OWN INITIATIVE, REPLACE SAID EMPLOYEE WITH ANOTHER OF EQUIVALENT TECHNICAL SKILL, AT NO ADDITIONAL COST TO THE UNIVERSITY.



1.15 SMOKE AND TOBACCO-FREE ENVIRONMENT: THE UNIVERSITY OF CALIFORNIA DAVIS IS COMMITTED TO A HEALTHY CAMPUS AND WORKPLACE CULTURE AND ENVIRONMENT. EFFECTIVE JANUARY 2, 2014, THE UNIVERSITY OF CALIFORNIA DAVIS IS A SMOKE AND TOBACCO-FREE ENVIRONMENT. SMOKING AND THE USE OF SMOKELESS TOBACCO PRODUCTS (E.G., E-CIGARETTES AND OTHER UNREGULATED NICOTINE PRODUCTS) IS STRICTLY PROHIBITED ON ALL UNIVERSITY OF CALIFORNIA DAVIS-CONTROLLED PROPERTIES, OWNED OR LEASED AND REGARDLESS OF LOCATION. THIS POLICY IS INTENDED TO PROVIDE A HEALTHIER, SAFER, AND PRODUCTIVE WORK AND LEARNING ENVIRONMENT FOR THE ENTIRE UNIVERSITY OF CALIFORNIA DAVIS COMMUNITY. FOR MORE INFORMATION ON THE SMOKE/TOBACCO-FREE POLICY, PLEASE VISIT ([HTTP://BREATHEFREE.UCDAVIS.EDU](http://breathefree.ucdavis.edu)). FOR MORE INFORMATION ON THE PRESIDENT'S MANDATE AND OTHER RELATED RESOURCES, PLEASE VISIT [HTTP://UCTOBACCOFREE.COM/](http://uctobaccofree.com/).

1.16 ALCOHOLIC BEVERAGES ARE PROHIBITED ON THE UNIVERSITY'S PROJECT SITE.

1.17 INTERRUPTION OF BUILDING SERVICES

1.18 PLANNED UTILITY SERVICE SHUTDOWNS SHALL BE ACCOMPLISHED DURING PERIODS OF MINIMUM USAGE. IN SOME CASES, THIS WILL REQUIRE WORK ACTIVITIES BEFORE 8:00 A.M. AND AFTER 5:00 P.M. AND WEEKEND WORK, AT NO ADDITIONAL COST TO THE UNIVERSITY. AT LEAST 14 CALENDAR DAYS ADVANCE NOTICE SHALL BE GIVEN TO THE UNIVERSITY'S REPRESENTATIVE BEFORE INTERRUPTIONS TO UTILITY SERVICE (REFER TO UTILITY SERVICE INTERRUPTION/SHUT DOWN REQUEST) AND OTHER INTERFERENCES WITH USE OF EXISTING BUILDINGS, SURROUNDING HARDSCAPE AND ROADS.

1.19 SHUTDOWNS CRITICAL TO THE COMPLETION OF THE PROJECT SHALL BE LISTED AS MILESTONES ON THE PROJECT SCHEDULE. THE CONTRACTOR SHALL PROGRAM WORK SO THAT SERVICE WILL BE RESTORED IN THE MINIMUM POSSIBLE TIME AND SHALL COOPERATE WITH THE UNIVERSITY IN REDUCING SHUTDOWNS OF UTILITY SYSTEMS.

1.20 THE UNIVERSITY RESERVES THE RIGHT TO DENY SHUTDOWN REQUESTS BASED ON SCHEDULED WORKLOAD, RESEARCH PROJECTS, AND USAGE OF SURROUNDING BUILDINGS OR OTHER ACTIVITIES PLANNED ON CAMPUS.

1.21 UNIVERSITY'S COSTS FOR INITIAL PLANNED UTILITY SERVICE SHUTDOWNS SHALL BE BORNE BY THE UNIVERSITY. IF REPEAT UTILITY SERVICE SHUTDOWNS ARE REQUIRED DUE TO WORK NECESSARY TO CORRECT CONTRACTOR'S DEFECTIVE WORK, MISTAKES IN NEW WORK LAYOUT SUCH AS MISALIGNMENT OR INSTALLATION CONFLICTS WITH OTHER NEW WORK, UNIVERSITY'S COSTS FOR REPEAT SHUTDOWN(S) WILL BE DEDUCTED FROM CONTRACT SUM.

1.22 SITE INGRESS AND EGRESS

1.23 ACCESS TO PROJECT SITE SHALL BE AS INDICATED ON THE DRAWINGS. ACCESS TO PROJECT SITE IS LIMITED TO DESIGNATED ROUTING ON EXISTING ACCESS ROADS. THE CONTRACTOR AND THEIR EMPLOYEES, SUB CONTRACTORS, SUPPLIERS OR DELIVERY PERSONAL MUST STAY ON THE DESIGNATED ROADS AND MAY NOT DRIVE, RIDE OR WALK TO OTHER LOCATIONS UNLESS PRIOR PERMISSION IS PROVIDED IN WRITING BY THE UNIVERSITY'S REPRESENTATIVE.

1.24 CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTION TO ENSURE THE SAFETY OF THE BICYCLISTS AND PEDESTRIANS THAT USE THE CAMPUS ROADS.

1.25 CONTRACTOR SHALL CLEAN THE SITE ACCESS AND ROADS AFFECTED BY THE WORK AND SHALL MAINTAIN SUCH IN A DUST FREE AND SAFE AND USABLE CONDITION FOR MOTORISTS, BICYCLISTS AND PEDESTRIANS. DURING INCLEMENT WEATHER CONTRACTOR SHALL CLOSELY MONITOR CONDITIONS TO PREVENT SLICKNESS OF ROADS.

1.26 CONTRACTOR SHALL BE PERMITTED TO BLOCK ONLY 1/2 OF A STREET AT A TIME FOR MOMENTARY SITE ACCESS, UNLESS SPECIFIED OTHERWISE. THE STREET SHALL BE OPERATIONAL AND USABLE BY THE UNIVERSITY AT ALL TIMES.

1.27 MOTOR VEHICLE AND BICYCLE TRAFFIC CONTROL

1.28 CONTRACTOR SHALL ADOPT ALL PRACTICAL MEANS TO MINIMIZE INTERFERENCE TO TRAFFIC. ACCESS TO OTHER FACILITIES IN THE AREA SHALL BE MAINTAINED AT ALL TIMES. THE CONTRACTOR SHALL PROVIDE A SCHEDULE OF ANY ACTIVITY THAT WILL IMPACT TRAFFIC, OR ANY PLANNED LANE OR STREET CLOSURE, FOR APPROVAL BY THE UNIVERSITY'S REPRESENTATIVE AND SHALL GIVE A MINIMUM OF 14 BUSINESS DAYS NOTICE BEFORE CLOSING ANY STREET OR ACCESS.

1.29 CONTRACTOR SHALL FURNISH AT CONTRACTOR'S EXPENSE ALL SIGNAGE BARRICADES, LIGHTS, AND FLAGGERS REQUIRED TO CONTROL TRAFFIC AND SHALL PROVIDE AND MAINTAIN SUITABLE TEMPORARY BARRICADES, FENCES, DIRECTIONAL SIGNS, OR OTHER STRUCTURES AS REQUIRED FOR THE PROTECTION OF THE PUBLIC; AND MAINTAIN, FROM THE BEGINNING OF TWILIGHT THROUGH THE WHOLE OF EVERY NIGHT ON OR NEAR THE OBSTRUCTIONS, SUFFICIENT LIGHTS AND BARRICADES TO PROTECT THE PUBLIC AND WORK.

1.30 CONTRACTOR SHALL PROVIDE DIRECTIONAL SIGNS FOR USE THROUGHOUT THE DURATION OF THE PROJECT. THE QUANTITY SHALL BE DETERMINED BY THE UNIVERSITY'S REPRESENTATIVE AND CONTRACTOR DURING A MANDATORY PRE-CONSTRUCTION SITE MEETING. CONTRACTOR SHALL PREPARE A MOCK-UP OF THE SIGN FOR APPROVAL BY THE UNIVERSITY'S REPRESENTATIVE.

1.31 IT IS THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING WORK ON, OR ADJACENT TO, A ROADWAY OR HIGHWAY TO INSTALL AND MAINTAIN SUCH DEVICES WHICH ARE NECESSARY TO PROVIDE REASONABLY SAFE PASSAGE FOR THE TRAVELING PUBLIC, INCLUDING PEDESTRIANS AND BICYCLISTS, THROUGH THE WORK, AS WELL AS FOR THE SAFEGUARD OF WORKERS. BEFORE WORK BEGINS, A SITE MEETING SHALL BE HELD TO DISCUSS MOTOR VEHICLE AND BICYCLE TRAFFIC CONTROL PLANS FOR HANDLING TRAFFIC THROUGH A CONSTRUCTION OR MAINTENANCE ZONE. TRAFFIC CONTROL PLANS SHALL BE SUBMITTED FOR REVIEW BY THE UNIVERSITY'S REPRESENTATIVE AND PUBLIC AGENCY OR AUTHORITY HAVING JURISDICTION OVER THE ROADWAY OR HIGHWAY. THESE TRAFFIC CONTROL PLANS SHALL BE PREPARED BY PERSONS KNOWLEDGEABLE ABOUT THE FUNDAMENTAL PRINCIPALS OF TEMPORARY TRAFFIC CONTROLS AND THE WORK ACTIVITIES TO BE PERFORMED. THE DESIGN, SELECTION, AND PLACEMENT OF TRAFFIC CONTROL DEVICES FOR THE TRAFFIC CONTROL PLAN SHALL BE BASED ON ENGINEERING JUDGMENT AND IN ACCORDANCE WITH PART 6 OF THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.

1.32 ALL METAL PLATING AND METAL BRIDGING SHALL BE NON-SKID WITH WAFFLE-PATTERNS OR RIGHT-ANGLE UNDULATIONS OR SHALL BE COATED WITH A NON-SKID PRODUCT. PLATING SHALL BE INSTALLED WITH NO PROTRUDING EDGES OR CORNERS STICKING UP AND WITH NO BOUNCING OR SHIFTING.

1.33 - PRODUCTS – NOT APPLICABLE TO THIS SECTION.

1.34 - EXECUTION – NOT APPLICABLE TO THIS SECTION.

**END OF SECTION 011400**

**SECTION 012200**

**ALLOWANCES**

**PART I - GENERAL**

1.01 GENERAL

- A. THE CONTRACT LUMP SUM BASE BID AS ENTERED IN ARTICLE 4.0 OF THE BID FORM SHALL INCLUDE THE AMOUNTS FOR ALL ALLOWANCES REQUIRED IN THIS SECTION AND ELSEWHERE IN THE CONTRACT DOCUMENTS. ALL ALLOWANCES SHALL BE PROVIDED BY THE CONTRACTOR FOR THE AMOUNTS INDICATED.
- B. THE FOLLOWING SHALL APPLY TO THE ALLOWANCES, UNLESS OTHERWISE INDICATED IN THE CONTRACT DOCUMENTS:
  - 1. ALLOWANCE AMOUNTS SHALL BE FOR THE FULL AMOUNT OF COMPENSATION, BOTH DIRECT AND INDIRECT, AND CONTAIN ALL OVERHEAD COSTS INCLUDING BUT NOT LIMITED TO SUPERVISION, SUPPORT, TAXES, BONDS, INSURANCE, AND PROFIT.
  - 2. ALLOWANCES SHALL BE FOR COMPLETE COMPENSATION TO THE CONTRACTOR FOR ALL MATERIALS AND EQUIPMENT DELIVERED AT THE PROJECT SITE, INCLUDING ALL OVERHEAD, TAXES, INSURANCE, SHIPPING, AND HANDLING.
  - 3. ALLOWANCES SHALL BE FOR COMPLETE COMPENSATION TO THE CONTRACTOR FOR ALL LABOR AMOUNTS AND SHALL INCLUDE ALL OVERHEAD, SUPERVISION, SUPPORT, TOOLS AND EQUIPMENT TO PERFORM THE WORK DIRECTED BY THE UNIVERSITY'S REPRESENTATIVE.
  - 4. ALLOWANCES FOR TRADESMEN IN LABOR AMOUNTS WILL BE UTILIZED AND DIRECTED BY THE UNIVERSITY'S REPRESENTATIVE. THESE AMOUNTS ARE FOR WORK NOT INCLUDED IN THE SCOPE OF THE CONTRACT DOCUMENTS AND ARE SOLELY FOR THE USE AND DIRECTION BY THE UNIVERSITY'S REPRESENTATIVE
  - 5. UPON PROJECT CLOSEOUT, ADJUSTMENTS FOR ANY REMAINING QUANTITIES OF THE AMOUNTS INCLUDED IN THE ALLOWANCES WILL BE DELETED FROM THE CONTRACT SUM ON A PER UNIT BASIS.

1.02 DESCRIPTION OF ALLOWANCES

- A. NONE

**PART II – PRODUCTS – NOT APPLICABLE TO THIS SECTION.**

**PART III – EXECUTION – NOT APPLICABLE TO THIS SECTION.**

**END OF SECTION 012200**

**SECTION 01 23 00**

**ALTERNATES**

**PART I - GENERAL**

1.01 GENERAL

- A. This Section identifies each Alternate and describes basic changes to the Work only when that Alternative is made a part of the Work by specific provision in the Agreement.
- B. Lump Sum Base Bid and Alternates shall include costs of all supporting elements required, so that combination of Lump Sum Base Bid and any Alternates shall be complete. Scope of Work for all Alternates shall be in accordance with applicable Drawings and Specifications.
- C. Except as otherwise specifically provided by University, Work described in Alternates shall be completed with no increase in Contract Time.
- D. This Section includes only non-technical descriptions of the Alternates. Refer to Sections of Division 2 - 48 of the Specifications for technical descriptions of the Alternates.
- E. Coordinate related Work and modify surrounding Work as required to integrate Alternates into the Work properly and completely.

1.02 DESCRIPTION OF ALTERNATES

- A. None

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not applicable to this Section**

**END OF SECTION 01 23 00**

## SECTION 012500

### CLARIFICATION/INFORMATION PROCEDURES

#### PART I - GENERAL

##### 1.01 DESCRIPTION

- A. This Section contains the procedures to be followed by Contractor for submitting a Request for Information (RFI) upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or Drawings or upon having any question concerning interpretation.
- B. Section Includes
  - 1. RFI Administrative requirements
  - 2. RFI Procedures
  - 3. RFI Execution

##### 1.02 RELATED DOCUMENT SECTIONS

- A. Conditions of the Contract: Governing requirements for changes in the Work, in Contract Sum and Contract Time.
- B. Section 016100 – PRODUCT REQUIREMENTS: Product options, substitutions, omissions, and improper descriptions.

##### 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Description: Section provides procedure for Contractors to obtain interpretation or clarification of the Contract Documents, or identify apparent conflicts, omissions, or errors in the Contract Documents.
- B. Responsible Person for Contractor: Submit name of the individual authorized to receive Requests for Information documents, and who is responsible for forwarding Request.
- C. RFI Format: Submit all Requests for Information on the form attached at the back of this Section, or electronic and/or web-based construction administration software provided or accepted by the University.

#### 1.04 RFI PROCEDURES

##### A. RFI Format, Numbering and Subject:

1. RFI Format: Submit all requests for clarification or additional information in writing to University's Representative using the RFI Request for Information form provided at the back of this Section or obtained from University's Representative.
2. RFI Numbering: Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix for resubmissions. For example, the first RFI is numbered "001". The second RFI is numbered "002" and so on. The first resubmittal of RFI "002" will be numbered "002a".
3. RFI Subject: Limit each RFI to one (1) subject only.

##### B. RFI Submittal conditions:

1. Discovery of unforeseen condition or circumstance not described in the Contract Documents.
2. Discovery of an apparent conflict, discrepancy, or inconsistency in or between portions of the Contract Documents.
3. Discovery of a situation, direction or apparent omission that cannot be reasonably inferred from the intent of the Contract Documents.

#### **PART II - PRODUCTS – Not Applicable to this Section**

#### **PART III - EXECUTION**

##### 3.01 EXECUTION OF RFI's

- A. Email the University's Representative the RFIs. Emailed RFI requests received after normal business hours and/or received on non-normal workdays, as defined in Specification Section 013100–COORDINATION, Item 1.07.F.4.A will begin notification time starting at 7:00 a.m. the following workday.
- B. Failure to provide proper information: RFIs will not be recognized or accepted if, in the opinion of University's Representative, one of the following conditions exist:
  1. Contractor submits the RFI as a request for substitution.
  2. Contractor submits the RFI as a Submittal.
  3. Contractor submits the RFI as a Contract Document discrepancy or omission without through review of the Documents (Capricious submission).
  4. Contractor submits the RFI assuming portions of the Contract Documents are excluded or by taking an isolated portion of the Contract Document in part rather than in whole.
  5. Contractor submits the RFI in an untimely manner without proper coordination and scheduling of Work of other Trades.

- C. Response Time: Request clarifications or information immediately upon discovery of need. Submit RFI's in a timely manner allowing full response time to avoid impacting Contract Schedule.
  - 1. University's Representative, whose decision will be final, shall resolve issues and respond to questions of Contractor, in most cases, within fourteen (14) calendar days. Actual time may be lengthened for complex issues, or shortened for expedited situations, as mutually agreed in writing.
  - 2. After submission of an RFI by Contractor and prior to receipt of the RFI response from University, the Contractor proceeds with effected Work at own risk. Any portion of the Work not constructed in accordance with University interpretation, clarification, instruction or decision is subject to removal and replacement at Contractor expense.
- D. Failure to Agree: In the event of failure to agree to the scope of the Contract requirements, Contractor shall follow procedures set forth in Article 4 of the General Conditions of the Contract.

3.02 Refer to the following Attachment

- A. Request for Information

**END OF SECTION 012500**



**REQUEST FOR INFORMATION**

**Project #:** \_\_\_\_\_ **Project Title:** \_\_\_\_\_  
**RFI #:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **HCAI #:** \_\_\_\_\_

|  |       |  |
|--|-------|--|
| UC Davis Health<br>Facilities Design & Construction<br>4800 2 <sup>nd</sup> Avenue, Suite 3010, Sacramento, CA 95817<br><b>Attn.: Zach Price</b><br>P: 916-734-####<br>C:916-919-6319<br>Email: zprice@ucdavis.edu | From: |  |
|  |       |  |
|  |       |  |
|  |       |  |
|  |       |  |
|  |       |  |

**SUBJECT:** \_\_\_\_\_  
 \_\_\_\_\_

**SPEC SECTION/DRAWING #:** \_\_\_\_\_ **PARA:** \_\_\_\_\_ **DETAIL:** \_\_\_\_\_  
**RM #** \_\_\_\_\_ **GRID #** \_\_\_\_\_

| TRANSMITTAL RECORD | Requestor to FD&C | FD&C to A/E | A/E to FD&C | FD&C to Requestor | Notes |
|--------------------|-------------------|-------------|-------------|-------------------|-------|
| Date Submitted     |                   |             |             |                   |       |

**INFORMATION NEEDED:** \_\_\_\_\_  
 \_\_\_\_\_

**CONTRACTOR'S PROPOSED RESOLUTION:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**REQUESTOR SIGNATURE:** \_\_\_\_\_ **REPLY REQUIRED BY:** \_\_\_\_\_

**ATTACHMENTS:** \_\_\_\_\_  
 \_\_\_\_\_

**REPLY:** \_\_\_\_\_  
 \_\_\_\_\_

**REPONDER SIGNATURE:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

UNLESS OTHERWISE INDICATED ABOVE, THE REPLY TO THIS RFI IS NOT INTENDED TO BE A CHANGE DIRECTIVE. SHOULD THE CONTRACTOR, SUBCONTRACTOR, OR SUPPLIERS FEEL THAT THE REPLY WILL IMPACT THE PROJECT COST OR SCHEDULE; IT SHOULD IMMEDIATELY BE CONVEYED TO THE UNIVERSITY'S FD&C PROJECT MANAGER IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

**COPIES:**     University     CONSULTANTS     \_\_\_\_\_     \_\_\_\_\_     \_\_\_\_\_     FILE

## SECTION 012550

### CONTRACT MODIFICATION PROCEDURES

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Change Order Administrative Requirements
- B. Documentation of Change in Contract Sum and Contract Time
- C. Change Procedures
- D. Field Orders
- E. Stipulated Sum Change Orders
- F. Unit Price Change Orders
- G. Time and Material Change Orders
- H. Cost Proposals and Supporting Documentation
- I. Execution of Change Orders
- J. Reconciliation of Change Orders

##### 1.02 RELATED DOCUMENT SECTIONS

- A. General Conditions of the Contract: Governing requirements for changes in the Work, in Contract Sum and Contract Time.
- B. Section 012500 – CLARIFICATION/INFORMATION PROCEDURES
- C. Section 012900 – MEASUREMENT AND PAYMENT: Applications for Payment.
- D. Section 016100 – PRODUCT REQUIREMENTS: Product options, substitutions, omissions, and improper descriptions.
- E. Section 017700 – CLOSEOUT PROCEDURES: Project record documents.

##### 1.03 DEFINITIONS

- A. Total Wage Rate: Base rate paid to the worker, including his/her fringe benefits, workman's compensation insurance and subsequent payroll taxes paid by the employer.
  - 1. Use Wage Rate Calculator issued with Division One.
  - 2. Projects in the University Controlled Insurance Program (UCIP) should not include workman's compensation in the wage rates.

- B. Consumables: Material purchased in bulk and not expressly accounted for in the listed materials on a change order request. These include but are not limited to, rags, washers, screws, nuts, small bolts, lubricants, cleaning materials, pens, chalk, pencils, tie wire, caution tape, etc. Compensation for consumables shall be incorporated as a 3% percentage increase on direct material costs for trades where these items are routinely used.
- C. Non-working Supervision: Non-working supervision is not allowed to be included on a change order per GC article 7.3.3.

#### 1.04 SUBMITTALS

- A. Submit the items listed below prior to submitting the 2<sup>nd</sup> Application for Payment.
  - 1. Total Wage Rates: Provide a wage rates for each key worker of the General Contractor and all Subcontractor tradespeople using the University's digital form for review and in compliance with the general conditions article 7 for approval by the University. Approved rates will be used in the Exhibit 7 Labor Rate Breakdown forms submitted with each Cost Proposal.

#### 1.05 CHANGE ORDER ADMINISTRATIVE REQUIREMENTS

- A. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ of subcontractors of changes in the work.
- B. Exhibit 7 of the Contract includes the following Forms:
  - 1. COST PROPOSAL Form
  - 2. SUPPORTING DOCUMENTATION FOR THE COST PROPOSAL SUMMARY Form
  - 3. CHANGE ORDER Form
  - 4. REPORT OF SUBCONTRACTOR INFORMATION Form

#### 1.06 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

- A. Documentation of Changes in Contract Sum and Contract Time: Provide full information required for evaluation of proposal, of proposed changes and to substantiate costs of changes in the Work.
  - 1. Maintain detailed records of Work completed on time and material basis.
  - 2. Document each quotation for a change in Contract Sum and Contract Time with sufficient data to allow evaluation of the quotation.

- B. Additional Data: Upon request, provide additional data to support computations.
  - 1. Quantities of products, labor, and equipment.
  - 2. Taxes, insurance, and bonds.
  - 3. Overhead and profit.
  - 4. Justification for change in Contract Time, if claimed.
  - 5. Credit for deletions from Contract, similarly documented.

#### 1.07 CHANGE PROCEDURES

- A. University's Supplemental Instructions: Minor changes in the Work, not involving adjustments to the Contract Sum or Contract time, as authorized by the General Conditions of the Contract, may be presented using Supplemental Instructions or correspondence containing similar information.
- B. University Initiated Changes: A Request for Proposal may be issued by University's Representative, which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications.
  - 1. The Request for Proposal may include an estimate of additions or deductions in the Contract Sum or Contract Time for executing the change and may include stipulations regarding overtime work and the period of time the requested response from the Contractor shall be considered valid.
  - 2. Contractor shall prepare and submit a response to the Request for Proposal within fourteen (14) calendar days.
- C. Contractor initiated Changes: Contractor may propose a change by submitting a request for change to University's Representative, describing proposed change and its full effect on the Work.
  - 1. Include statement describing reason for change, and full description of effects on Contract Sum, Contract Time, related Work and work being performed under separate contracts.
  - 2. Requests for substitutions shall be included under this category, with procedures as specified in Section 016100 – PRODUCT REQUIREMENTS.

1.08 FIELD ORDER

- A. Field Order: University's Representative may issue a Field Order, signed by University's Representative, instructing the Contractor to proceed immediately with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. The document will describe changes in the Work, and will designate the method of determining what, if any, change is due in the Contract Sum or the Contract Time.
  - 2. Promptly execute the change in the Work indicated in the Field Order prior to acceptance of a Cost Proposal for the Work by the University.
- B. Cost and Time Resolution: Costs and time adjustments for changes in the Work shall be per provisions of the General Conditions of the Contract, unless otherwise agreed to prior to issuance.

1.09 CHANGE ORDERS

- A. Stipulated Sum Change Orders: Contractor's response to Request for Proposal or Field Order will be considered and a mutually acceptable adjustment in Contract Sum and Contract Time will be determined. Change Order for this stipulated amount will be prepared by University's Representative for execution by University and Contractor.
- B. Unit Price Change Order: Change Order will be prepared by University's Representative for execution by University and Contractor, based on mutually acceptable quantities and pre-determined unit prices.
  - 1. For unit cost or quantities not pre-determined, the Work shall be accomplished under a Stipulated Sum Change Order, if there is no dispute over the estimated or stipulated maximum cost and time for the change.
  - 2. If the amounts are not defined or are disputed, a Field Order will be prepared and issued by University's Representative.
- C. Time and Material Change Orders: As directed for changes for where amounts are not defined or are disputed, Contractor shall execute the Work, keeping accurate records of time, both labor and calendar days, and cost of materials.
  - 1. Contractor shall prepare and submit an itemized account and supporting data after completion of the change, within the time limits indicated in the Conditions of the Contract.
  - 2. University's Representative will determine the change allowable in Contract Sum and Contract Time, as provided elsewhere in the Contract Documents, and make recommendation to University for acceptance of Change Order.
  - 3. Contractor shall provide full information as required and requested for evaluation of proposed changes, and to substantiate costs for changes in the Work.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION**

3.01 CONTENT OF COST PROPOSALS

- A. Cost Proposals shall include the following:
  - 1. Detailed description of the work involved including:
    - a. What work is being performed?
    - b. Where the work is performed?
    - c. When the work was performed if already completed?
    - d. When the work is scheduled to be performed if not yet completed?
    - e. Why this work is a change to the contract?
  - 2. Detailed description of any time impacts associated with the work; refer to General Conditions, paragraph 8.4.
  - 3. Materials
    - a. Material shall be submitted at the cost paid by the contractor.
      - 1) Invoices may be required to validate that meet the following criteria:
        - a) Invoices may be from different projects if the following conditions are met:
          - (1) The COR is before the contractor would reasonably have the material on site to accomplish the COR.
          - (2) Recent, within last 6 months.
          - (3) There must be at least enough of the material in question to accomplish the work in the proposed COR.
        - b) The invoice shall not be modified from the version provided by the vendor.
  - 4. Labor unit breakdown backed up by some sort of industry standard (NECA for electrical, MCAA for plumbing and mechanical, SMACNA for mechanical, Etc.) These standards shall be used at their base rate, with no added percentages nor adjustments. This has been found to be a fair representation of the man-hours required to do these types of work.
    - a. This project has been determined as NECA normal.

5. Wage rate back up matching the submitted back up as described in 1.03.A.
- B. Submittal of a Cost Proposal using the Cost of the Work plus Contractor Fee described in General Conditions paragraphs 7.3.5 and 7.3.6 shall include the following items in addition to those listed above:
  1. Field Order instructing the change. Only a field order may instruct work to be completed using this basis.
  2. Material invoices shall be provided for any item used in Extra Work.
  3. Job site work tags identifying daily labor and material usage shall be submitted with:
    - a. Specific description of the work performed on that tag.
    - b. Identification of large equipment used
    - c. Identification of labor class for each individual
    - d. Location - room number, gridline or distinct location.
    - e. Signed by the Contractor and University's Representative.
- C. Any coordination required for implementation of a change into the work, documents, or model is and shall be considered part of the allowable markups provided in General Conditions paragraphs 7.3.3.1-18 and 7.3.4.

### 3.02 EXECUTION OF CHANGE ORDERS

- A. Execution of Change Orders: After the University's Representative has accepted the Change Order Proposal; the University's Representative shall prepare Change Order documents for signature by parties as provided in the Conditions of the Contract.

### 3.03 RECONCILIATION OF CHANGE ORDERS

- A. Schedule of Values: Promptly revise the Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjustment to the Contract Sum.
- B. Schedules: Upon completion of the Change Order, promptly revise progress schedules to reflect changes in Contract Time, revising sub-schedules to adjust time for other items of Work as may be affected by the change. Submit revised schedules with next Application for Payment.

**END OF SECTION 012550**

**SECTION 01 27 00**

**UNIT PRICES**

**GENERAL**

DESCRIPTION

- A. UNIT PRICE QUOTATIONS ARE TO BE INSERTED IN THE APPROPRIATE SPACES IN THE BID FORM FOR EACH UNIT PRICE ITEM OF WORK DESCRIBED HEREIN.
- B. UNIT PRICES STATED IN THE AGREEMENT SHALL BE USED TO COMPLETE ADJUSTMENTS OF THE CONTRACT SUM FOR APPROVED UNIT PRICE ITEMS OF WORK. SUCH ADJUSTMENTS SHALL BE MADE BY CHANGE ORDER.
- C. UNIT PRICES SHALL INCLUDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, DIRECT AND INDIRECT COSTS NECESSARY TO COMPLETE THE ITEM OF WORK AND COORDINATE THE WORK AND SHALL INCLUDE ALL OVERHEAD AND PROFIT. CONTRACTOR SHALL ACCEPT COMPENSATION COMPUTED IN ACCORDANCE WITH THE UNIT PRICES AS FULL COMPENSATION FOR FURNISHING SUCH WORK.
- D. COMPENSATION WILL BE PAID FOR THOSE ITEMS OF WORK DESCRIBED BELOW IN SUB-SECTION 2.01.

SPECIFIED WORK

- A. APPLICABLE SECTIONS OF THE SPECIFICATIONS DESCRIBE THE MATERIALS AND METHODS REQUIRED FOR THE VARIOUS UNIT PRICE ITEMS OF WORK.

**PRODUCTS**

- 2.01 UNIT PRICES
  - 1. NONE

**EXECUTION**

- 3.01 UNIT PRICES
  - A. IMMEDIATELY NOTIFY UNIVERSITY'S REPRESENTATIVE WHEN CONDITIONS REQUIRE USE OF UNIT PRICE ITEMS. {1, 2, 3, ETC.}.
  - B. THE APPLICABILITY OF MEASUREMENT METHODS FOR, DOCUMENTATION OF, AND FINAL ADJUSTMENT OF, THE CONTRACT SUM FOR UNIT PRICE ITEMS OF WORK SHALL BE DETERMINED BY UNIVERSITY'S REPRESENTATIVE. THE APPLICABILITY OF MEASUREMENT METHODS FOR, DOCUMENTATION OF, AND FINAL ADJUSTMENT OF, THE CONTRACT SUM FOR UNIT PRICE ITEMS OF WORK SHALL BE DETERMINED BY UNIVERSITY'S REPRESENTATIVE.



- C. AFTER PERFORMING UNIT PRICE ITEMS {1, 2, 3, ETC.} AS DESCRIBED BY UNIVERSITY'S REPRESENTATIVE, CONTRACTOR SHALL TAKE NECESSARY MEASUREMENTS IN THE PRESENCE OF UNIVERSITY'S REPRESENTATIVE AND SHALL SUBMIT CALCULATIONS OF QUANTITIES TO UNIVERSITY'S REPRESENTATIVE FOR APPROVAL. CONTRACTOR SHALL NOTIFY UNIVERSITY'S REPRESENTATIVE SEVEN (7) CALENDAR DAYS IN ADVANCE OF TAKING MEASUREMENTS.

**END OF SECTION 01 27 00**

**SECTION 01 29 00**  
**MEASUREMENT AND PAYMENT**

**GENERAL**

SECTION INCLUDES

- A. PROCEDURES FOR PREPARATION AND PRESENTATION OF APPLICATION FOR PAYMENT.
- B. PROCEDURES FOR PREPARATION AND PRESENTATION OF SCHEDULE OF VALUES.

RELATED DOCUMENTS AND SECTIONS

- C. GENERAL CONDITIONS OF THE CONTRACT: PROGRESS PAYMENTS AND FINAL PAYMENT.
- D. SECTION 013200 – CONTRACT SCHEDULES
- E. SECTION 017700 – CLOSEOUT PROCEDURES
- F. SECTION 017800 – CLOSEOUT SUBMITTALS

PAYMENT APPLICATION FORM

- G. PAYMENT APPLICATION FORM: PREPARE APPLICATIONS FOR PAYMENT USING EXHIBIT 4 PROVIDED IN THE CONTRACT.

SCHEDULE OF VALUES

- H. COORDINATION. COORDINATE PREPARATION OF THE SCHEDULE OF VALUES WITH PREPARATION OF THE CONTRACTOR'S CONTRACT SCHEDULE AND AS DIRECTED BY THE UNIVERSITY'S REPRESENTATIVE.
  - 1. CORRELATE LINE ITEMS IN THE SCHEDULE OF VALUES WITH OTHER REQUIRED ADMINISTRATIVE SCHEDULES AND FORMS, INCLUDING:
    - A. CONTRACTOR'S CONTRACT SCHEDULE.
    - B. APPLICATION FOR PAYMENT FORM.
    - C. LIST OF SUBCONTRACTORS.
    - D. LIST OF PRODUCTS (WHERE/IF APPROPRIATE).
    - E. LIST OF PRINCIPAL SUPPLIER AND FABRICATORS.
    - F. SUBMITTAL SCHEDULE
    - G. CONSTRUCTION COST BREAKDOWN SHEET.

2. SUBMIT THE SCHEDULE OF VALUES TO THE UNIVERSITY'S REPRESENTATIVE AT THE EARLIEST FEASIBLE DATE, BUT IN NO CASE LATER THAN 7 CALENDAR DAYS BEFORE THE DATE SCHEDULED FOR SUBMITTAL OF THE INITIAL APPLICATION FOR PAYMENT.
- I. FORMAT AND CONTENT. USE THE SPECIFICATION TABLE OF CONTENTS AS A GUIDE TO ESTABLISH THE FORMAT FOR THE SCHEDULE OF VALUES.
1. INCLUDE THE FOLLOWING PROJECT IDENTIFICATION ON THE SCHEDULE OF VALUES:
    - A. PROJECT NAME AND LOCATION.
    - B. NAME OF THE UNIVERSITY'S REPRESENTATIVE.
    - C. PROJECT NUMBER.
    - D. CONTRACTOR'S NAME AND ADDRESS.
    - E. DATE OF SUBMITTAL.
  2. ARRANGE THE SCHEDULE OF VALUES IN A TABULAR FORM WITH SEPARATE COLUMNS TO INDICATE THE FOLLOWING FOR EACH ITEM LISTED:
    - A. GENERIC NAME.
    - B. PERFORMANCE SPECIFICATION OR UNIVERSITY SPECIFICATION SECTION.
    - C. NAME OF SUBCONTRACTOR.
    - D. NAME OF MANUFACTURER OR FABRICATOR.
    - E. NAME OF SUPPLIER (IF APPROPRIATE).
    - F. CHANGE ORDERS (NUMBER) THAT HAVE AFFECTED VALUE.
    - G. DOLLAR VALUE. (PERCENTAGE OF CONTRACT SUM TO THE NEAREST ONE-HUNDREDTH PERCENT, ADJUSTED TO TOTAL 100 PERCENT.)
  3. PROVIDE A BREAKDOWN OF THE CONTRACT SUM IN SUFFICIENT DETAIL TO FACILITATE CONTINUED EVALUATION OF APPLICATIONS FOR PAYMENT AND PROGRESS REPORTS. BREAK PRINCIPAL SUBCONTRACT AMOUNTS DOWN INTO SEVERAL LINE ITEMS.
  4. ROUND AMOUNTS OFF TO THE NEAREST WHOLE DOLLAR; THE TOTAL SHALL EQUAL THE CONTRACT SUM.
  5. FOR EACH PART OF THE WORK WHERE AN APPLICATION FOR PAYMENT MAY INCLUDE MATERIALS OR EQUIPMENT, PURCHASED OR FABRICATED AND STORED, BUT NOT YET INSTALLED, PROVIDE SEPARATE LINE ITEMS ON THE SCHEDULE OF VALUES FOR INITIAL COST

OF THE MATERIALS, FOR EACH SUBSEQUENT STAGE OF COMPLETION,  
AND FOR TOTAL INSTALLED VALUE OF THAT PART OF THE WORK.

- A. DIFFERENTIATE BETWEEN ITEMS STORED ON-SITE AND ITEMS STORED OFF-SITE. INCLUDE REQUIREMENTS FOR INSURANCE AND BONDED WAREHOUSING, IF REQUIRED.

6. PROVIDE SEPARATE LINE ITEMS ON THE SCHEDULE OF VALUES FOR INITIAL COST OF THE MATERIALS, FOR EACH SUBSEQUENT STAGE OF COMPLETION, AND FOR TOTAL INSTALLED VALUE OF THAT PART OF THE WORK.
7. **CONTRACTOR/CM/CONTRACTOR'S** GENERAL CONDITIONS OVERHEAD AND PROFIT SHALL BE A SEPARATE LINE ITEM PER MONTH.
8. ALLOWANCES (IF APPLICABLE). SHOW THE LINE ITEM VALUE OF ALLOWANCES.

#### PREPARATION OF APPLICATIONS

- J. PREPARATION OF APPLICATIONS FOR PAYMENT: THE FOLLOWING REQUIREMENTS SUPPLEMENT THE PROVISIONS OF THE GENERAL CONDITIONS OF THE CONTRACT. REFER TO THE GENERAL CONDITIONS OF THE CONTRACT.
  1. PRESENT REQUIRED INFORMATION IN PDF ELECTRONIC FILE ON THE REQUIRED FORMS. MEDIA-DRIVEN FORMS ARE ACCEPTABLE.
  2. EXECUTE CERTIFICATION BY VERIFIED ELECTRONIC SIGNATURE OF AUTHORIZED OFFICER OF THE **CONTRACTOR/CM/CONTRACTOR**.
  3. USE DATA FROM THE APPROVED SCHEDULE OF VALUES. PROVIDE DOLLAR VALUE IN EACH COLUMN OF APPLICATION FOR EACH LINE ITEM AND PORTION OF WORK PERFORMED AND FOR PRODUCTS STORED, IF PERMITTED.
    - A. LIST VALUE OF EACH MAJOR ITEM OF WORK AND EACH SUBCONTRACTED ITEM OF WORK AS A SEPARATE LINE ITEM TO SERVE AS A BASIS FOR COMPUTING VALUES FOR PROGRESS PAYMENTS. ROUND OFF VALUES TO NEAREST DOLLAR. LISTED ITEMS OF WORK SHALL BE IDENTIFIED BY SPECIFICATION SECTION NUMBER.
    - B. LIST PRODUCTS AND OPERATIONS OF EACH MAJOR SUBCONTRACT AS SEPARATE LINE ITEM.
    - C. INCLUDE WORK ALLOWANCES (IF ANY) WITHIN LINE ITEM OF WORK.
    - D. COORDINATE PERCENTAGE COMPLETE WITH PROGRESS SCHEDULE.
    - E. PROVIDE SEPARATE LINE ITEMS FOR EACH AREA OF WORK SUCH AS BUT NOT LIMITED TO FLOORS, ZONES, WINGS, OR OTHER AREAS THAT CAN BE CLEARLY IDENTIFIED.
    - F. THE SUM OF VALUES LISTED SHALL EQUAL TOTAL CONTRACT SUM.
  4. LIST EACH AUTHORIZED CHANGE ORDER AS AN EXTENSION ON THE CONTINUATION SHEET, LISTING THE CHANGE ORDER NUMBER AND DOLLAR VALUE AS FOR AN ORIGINAL ITEM OF WORK. CHANGE ORDER SHALL BE BROKEN DOWN SAME AS APPLICATION FOR PAYMENT.

5. NO CHANGE ORDER SHALL BE INCLUDED WITH APPLICATION FOR PAYMENT UNTIL APPROVED IN WRITING BY UNIVERSITY AND UNIVERSITY'S REPRESENTATIVE.
  6. REFER TO 1.05 FOR OTHER ITEMS REQUIRED FOR THE APPLICATION FOR PAYMENT.
- K. FINAL PAYMENT: PREPARE APPLICATION FOR FINAL PAYMENT AS SPECIFIED IN SECTION 017700 – CLOSEOUT PROCEDURES.

SUBMISSION OF APPLICATIONS FOR PAYMENT

- L. SUBMISSION OF APPLICATIONS FOR PAYMENT: THE FOLLOWING REQUIREMENTS SUPPLEMENT PROVISIONS OF THE GENERAL CONDITIONS OF THE CONTRACT. REFER TO THE GENERAL CONDITIONS OF THE CONTRACT.
1. SUBMIT ONE (1) PDF ELECTRONIC FILE OF EACH APPLICATION FOR PAYMENT WITH VERIFIED ELECTRONIC SIGNATURE, SUCH AS DOCUSIGN. ROUND VALUES TO NEAREST DOLLAR OR AS SPECIFIED FOR THE SCHEDULE OF VALUES.
  2. SUBMIT AN UPDATED CONSTRUCTION PROGRESS SCHEDULE WITH EACH APPLICATION FOR PAYMENT AND SPECIFIED IN SECTION 013200 – CONTRACT SCHEDULES.
  3. SUBMIT ONE (1) PDF ELECTRONIC FILE OF SCHEDULE OF VALUES IN ACCORDANCE WITH THE GENERAL CONDITIONS OF THE CONTRACT. FORM AND CONTENT SHALL BE ACCEPTABLE TO THE UNIVERSITY. TRANSMIT UNDER PDF ELECTRONIC TRANSMITTAL LETTER. IDENTIFY UNIVERSITY'S PROJECT NAME AND UNIVERSITY'S PROJECT NUMBER.
    - A. LIST INSTALLED VALUE OF EACH MAJOR ITEM OF WORK AND FOR EACH SUBCONTRACTED ITEM OF WORK AS A SEPARATE LINE ITEM TO SERVE AS A BASIS FOR COMPUTING VALUES FOR PROGRESS PAYMENTS. ROUND OFF VALUES TO NEAREST DOLLAR. LISTED ITEMS OF WORK SHALL BE IDENTIFIED BY SPECIFICATION SECTION NUMBER. EACH VALUE WILL BE BASED ON A PERCENT COMPLETE OF THAT LINE ITEM.
    - B. FOR EACH MAJOR SUBCONTRACT, LIST PRODUCTS AND OPERATIONS OF THAT SUBCONTRACT AS SEPARATE LINE ITEMS.
    - C. COORDINATE LISTINGS WITH PROGRESS SCHEDULE. **CONTRACTOR/CM/CONTRACTOR** PROJECT GENERAL CONDITIONS PLUS OVERHEAD AND PROFIT SHALL BE A SEPARATE LINE ITEM IN THE APPLICATION FOR PAYMENT; AND BE DIVIDED IN AN EQUAL AMOUNT FOR EACH MONTH PART OF THE CONTRACT TIME PERIOD.
      - 1) AT 50 PERCENT COMPLETION OF THE WORK, OR AT OTHER TIMES THE UNIVERSITY'S REPRESENTATIVE DEEMS APPROPRIATE, THE UNIVERSITY'S REPRESENTATIVE MAY REQUEST THE MONTHLY AMOUNT OF OVERHEAD AND PROFIT BE ADJUSTED, IF THE CONTRACT SCHEDULE INDICATES GOING BEYOND THE CONTRACT END DATE.

- D. FOR ITEMS ON WHICH PAYMENTS WILL BE REQUESTED FOR ON-SITE STORED PRODUCTS, LIST SUB-VALUES FOR COST OF ON-SITE STORED PRODUCTS WITH TAXES PAID. IF STORED PRODUCTS ARE NOT ON-SITE, THEY MUST BE STORED IN A BONDED WAREHOUSE OR LOCATION APPROVED BY THE UNIVERSITY'S REPRESENTATIVE PRIOR TO INCLUDING ON THE APPLICATION FOR PAYMENT.
  - E. SUBMIT A SUB-SCHEDULE FOR EACH SEPARATE PHASE OF WORK SPECIFIED IN SECTION 011100. INCLUDE SCHEDULING OF SEQUENCES WITHIN EACH PHASE INDICATED ON THE DRAWINGS.
  - F. THE SUM OF VALUES LISTED SHALL EQUAL TOTAL CONTRACT SUM.
  - G. WHEN UNIVERSITY'S REPRESENTATIVE REQUIRES SUBSTANTIATING INFORMATION, SUBMIT DATA JUSTIFYING LINE-ITEM AMOUNTS IN QUESTION.
  - H. PROVIDE ONE (1) PDF ELECTRONIC FILE OF DATA WITH COVER LETTER FOR EACH COPY OF APPLICATION. SHOW APPLICATION NUMBER AND DATE, AND LINE ITEM BY NUMBER AND DESCRIPTION.
4. SUBMIT APPLICATIONS FOR PAYMENT, CONTINUATION SHEETS AND SCHEDULE OF VALUES UNDER PDF ELECTRONIC TRANSMITTAL LETTER. **CONTRACTOR/CM/CONTRACTOR** SHALL IDENTIFY ALL PAYMENT APPLICATION DOCUMENTS BY UNIVERSITY'S PROJECT NAME AND UNIVERSITY'S PROJECT NUMBER.

SUBSTANTIATING DATA

- M. UNIVERSITY'S REPRESENTATIVE MAY REQUEST SUBSTANTIATING INFORMATION. SUBMIT DATA RECONCILING LINE-ITEM AMOUNTS IN QUESTION.
- N. PROVIDE ONE (1) PDF ELECTRONIC FILE OF DATA WITH COVER LETTER FOR EACH COPY OF SUBMITTAL. SHOW APPLICATION NUMBER INCLUDING DATE AND LINE ITEM BY NUMBER WITH DESCRIPTION.

**PRODUCTS – NOT APPLICABLE TO THIS SECTION**

**EXECUTION – NOT APPLICABLE TO THIS SECTION**

**END OF SECTION 01 29 00**

**SECTION 01 31 00**  
**COORDINATION**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Project Meetings
- B. Submittals Requirements
- C. General Contractor Coordination
- D. Coordination of Subcontractor and Separate Contracts
- E. University Criteria

1.02 RELATED REQUIREMENTS

- A. Section 011100 – SUMMARY OF THE WORK: Description of Contract Documents.
- B. Section 013200 – CONTRACT SCHEDULES
- C. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- D. Section 013500 – SPECIAL PROCEDURES: Interim Life Safety Measures (ILSM).
- E. Section 014500 – QUALITY CONTROL
- F. Section 014550 – INSPECTION AND TESTING OF WORK
- G. Section 015100 – TEMPORARY UTILITIES
- H. Section 015200 – CONSTRUCTION FACILITIES
- I. Section 015500 – VEHICULAR ACCESS AND PARKING: Traffic Regulation.
- J. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS
- K. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- L. Section 016100 – PRODUCT REQUIREMENTS
- M. Section 017300 – CUTTING AND PATCHING
- N. Section 017700 – CLOSEOUT PROCEDURES: Coordination of completion reviews, inspections, and submission of documents.



- O. Section 017800 – CLOSEOUT SUBMITTALS: As-Built Documents.
- P. Division 21 - Fire Protection Systems.
- Q. Division 28 - Fire Alarm Systems

1.03 MEETINGS

- A. Pre-Construction/Site Mobilization Conference: University's Representative will administer site mobilization conference at Project site for clarification of responsibilities of University, University's Representation and Contractor, use of site and for review of administrative procedures. Site mobilization conference shall be held within fourteen (14) calendar days of Notice to Proceed, unless otherwise directed by University's Representative.
  - 1. Agenda: Pre-Construction/Site Mobilization Conference shall cover the following topics at a minimum:
    - a. Special Project Procedures: Implementation of requirements as specified in Section 013100 – COORDINATION.
    - b. Subcontractors List: Provide PDF electronic file. Distribute and discuss list of subcontractors and suppliers.
    - c. Construction Schedule: Provide per Section 013200. Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work, including coordination of University furnished/Contractor installed (UFCI) products, University furnished/University installed (UFUI) products, and work under separate contracts, by utility agencies and companies and University.
    - d. Designation of Key personnel: Designate key personnel and update project directory for University, University's Consultants, Contractor, major subcontractors, major materials suppliers, serving utility agencies and companies, other contractors performing work under separate contracts and governing authorities having jurisdiction.
    - e. Project Communication Procedures: Review requirements and administrative requirements for written, electronic and oral communications.
    - f. Change Procedures: Review requirements and administrative procedures for Change Orders, Field Orders, University's Representative's Supplemental Instructions, and Contractor's Requests for Information.
    - g. Coordination: Review requirements for Contractor's coordination of Work; review sequence and schedule for work being performed for University under separate contracts.
    - h. Submittals Administration: Provide per Section 013300 and Section 016100. Review administrative procedures for shop drawings, project data and sample submittals and review of preliminary submittals schedule.

- i. Project As-Built Documents: Provide per Section 017700 and Section 017800. Review requirements and procedures for project as-builts, specifications and other documents.
  - j. Construction Facilities and Temporary Utilities: Provide per Section 015100 and Section 015200. Designate storage and staging areas, construction office areas; review temporary utility provisions; review University requirements for use of premises.
  - k. Materials and Equipment: Review substitution requirements; review schedule for major equipment purchases and deliveries; review materials and equipment to be provided by University (UFCI and UFUI products).
  - l. Site Access by University's Representative and University's Consultants: Review requirements and administrative procedures Contractor may institute for identification and reporting purposes.
  - m. Testing and Inspection: Provide per Section 014550 and other sections of the Contract. Review tests and inspections by independent testing and inspection agencies, manufacturers, and governing authorities having jurisdiction.
  - n. Permits and Fees: Review Contract requirements; review schedule and process for obtaining permits and paying fees.
  - o. Hours of Work and Work Restrictions per Section 011400.
  - p. Hot Works Permit.
- B. Billing Meetings: A billing meeting will be conducted by the University's Representative each month prior to submittal of the Application for Payment. Agenda: review of the percent complete relating to the submitted Schedule of Values. Prior to the Billing Meeting the Contractor will submit a draft of the Application for Payment for review by the IOR and University Representative.
- C. Progress Meetings: Progress meetings shall be periodically scheduled throughout progress of the Work. Frequency shall be as determined necessary for progress of Work. Generally, it is intended progress meetings be held once a week as designated by the University's Representative.
- 1. Administration: University's Representative shall make physical arrangements for meetings and prepare agenda with copies for participants, preside at meetings, record minutes and distribute an electronic file within four (4) workdays to Contractor University's Consultants, and other participants affected by decisions made at meetings.

2. Attendance: Contractor's Project Manager and jobsite Superintendent shall attend each meeting. Contractor's subcontractors and suppliers may attend as appropriate to subject under discussion. University will have a representative at each meeting. University's Consultants, as appropriate to agenda topics for each meeting and as provided in University/Consultant Agreement, will also attend.
  - a. Suggested Agenda for Progress Meetings:
    - 1) Building Code/Fire Marshal Issues
    - 2) Design Issues
    - 3) Submittals and Long Lead Items
    - 4) UFCI and UFUI products.
    - 5) Request for Information
    - 6) Safety Issues
    - 7) Scheduling Status/1 Week Prior and 32 Week Look Ahead
    - 8) Potential Schedule Delay Issues
    - 9) Incomplete or Non-Conforming Work
    - 10) Inspection Requests
    - 11) Utility Shutdowns and Dig Notifications
    - 12) Instructional Bulletins and Field Orders
    - 13) Change Orders/Cost Proposals
    - 14) Payment Applications and As-Built Documents
    - 15) Miscellaneous Business
    - 16) Other items affecting progress of the Work
- D. Guarantees, Bonds, Service and Maintenance Contracts Review Meeting: Eleven months following the date of Substantial Completion, a meeting will be conducted by University's Representative to review the guarantees, bonds and service and maintenance contracts for materials and equipment.
- E. In addition to meetings listed above, Contractor shall hold coordination meetings and pre-installation conferences to assure proper coordination of Work.
  1. Pre-installation Conferences: When required in individual Specification Sections, convene a pre-installation conference prior to commencing Work.
    - a. Require attendance by representatives of firms whose activities directly affect or are affected by the Work specified.

- b. Review conditions of installation, preparation and installation procedures and coordination with related Work and Work under separate contracts.
- F. Location of all meetings will be as designated by University's Representative. Participants at all meetings shall be University's Representatives, Consultants and/or Vendors, Contractor, Superintendent, Subcontractors and others as appropriate.

#### 1.04 SUBMITTALS

- A. Coordination of Submittals: Schedule and coordinate submittals as specified in Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, Section 017700 – CLOSEOUT PROCEDURES and Section 017800 – CLOSEOUT SUBMITTALS.
- 1. Coordinate submittal effort of various trades, subcontractors and suppliers having interdependent responsibilities for installing, connecting, and placing into service such equipment, materials or installations as necessary for the Work.
  - 2. Coordinate requests for substitutions to assure compatibility of space, operating elements, and effect on work of others.
  - 3. Contractor shall submit the following submittals to the University's Representative who will forward directly to the appropriate State Agencies for their review and approval:
    - a. Fire Protection Drawings: Refer to Division 21
    - b. Fire Alarm System: Refer to Division 28
    - c. Additional HCAI Deferred Approvals: Refer to list of deferred approvals as shown on the Contract Documents.
- B. Coordination/Engineering Drawings: Submit in accordance with Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES and as specified herein.
- C. Work Plans: Submit as specified herein.

#### 1.05 COORDINATION

- A. Coordination: Contractor shall coordinate the Work as stated in the General Conditions of the Contract. Work of the Contract includes coordination of the entire work of the Project, from beginning of construction activity through Project closeout and warranty periods. Contractor shall also coordinate Work under the Contract with work under separate contracts by University. Contractor shall cooperate with University and others as directed by University's Representative in scheduling and sequencing the incorporation into the Work of University Furnished/Contractor Installed (UFCI) products identified in the Contract Documents.
- 1. Coordinate completion and cleanup of work of the separate trades, subcontractors, vendors, etc., in preparation for University occupancy
  - 2. After University occupancy, coordinate access to site by various trades, subcontractors, vendors, etc., for correction of defective work and/or work not in accordance with Contract Documents, to minimize University disruption.

3. Assemble and coordinate closeout submittals specified in Section 017700 – CLOSEOUT PROCEDURES.
  - B. Construction Interfacing and Coordination: Layout, scheduling and sequencing of Work shall be solely Contractor's responsibility. Contractor shall bring together the various parts, components, systems and assemblies as required for the correct interfacing and integration of all elements of Work. Contractor shall coordinate Work to correctly and accurately connect abutting, adjoining, overlapping and related elements, including work under separate contracts by University and utility agencies, if any.
  - C. Installation of Systems into Project Space: Follow routings shown for pipes, ducts and conduits as closely as practicable, as shown on the Contract Documents with due allowance for available physical space; make runs parallel with line of building. Utilize space efficiently to maximize accessibility for other installations, future maintenance and repairs. In finished areas, except as otherwise shown, conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
  - D. Utility Work: Work occurring on or in the immediate vicinity of critical utilities must be directly supervised at all times by Contractor's qualified personnel. Requirements stated herein for notification, work plans, dig notification forms and marking locations of existing utilities shall apply. Contractor will be held fully liable for costs and damages due to unplanned interruption of critical utilities, including any personal injury to Hospital patients, visitors, or staff.
    1. Provide supervision and coordination necessary to meet requirements of electrical power connection as set forth by the Sacramento Municipal Utility District (SMUD).
    2. Provide reasonable and convenient staging and access areas to permit SMUD, its vendors or subcontractors, to install, modify or remove electrical transformers or other components of the electrical power system furnished and installed by SMUD.

#### 1.06 COORDINATION OF SUBCONTRACTORS AND SEPARATE CONTRACTS

- A. Conflicts: Conflicts shall be resolved by the Contractor. Contractor bears primary responsibility for conflict resolution regarding the coordination of all building trades, subcontractors and suppliers.
- B. Superintendence of Work: Contractor shall appoint a field superintendent who shall direct, supervise, and coordinate all Work in the Contract Documents.
- C. Subcontractors, Trades and Materials Suppliers: Contractor shall require all subcontractors, trades, crafts and suppliers to coordinate their portions of Work with the Superintendent to prevent scheduling, sequencing, dimensional and other conflicts and omissions.
- D. Coordination with Work Under Separate Contracts: Contractor shall coordinate and schedule Work under Contract with work being performed for Project under separate contracts by University. Contractor shall make direct contacts with parties responsible for work of the Project under separate contracts, in order to provide timely notifications and to facilitate information exchanges.

- E. Service Connections: Except as otherwise indicated, final connection of mechanical services to general work is defined as being mechanical work; final connection of electrical services to general work is defined as electrical work.

#### 1.07 UNIVERSITY CRITERIA

- A. During the Base Construction time, Contractor shall allow University [enter specific number of calendar days] to move University equipment and/or provide furnishings in [specify area]. Contractor shall notify University's Representative in writing a minimum of fourteen (14) calendar days prior to completion of area described above.
  - 1. Contractor shall show this time as a distinct activity on the detailed project schedule.
  - 2. Allow 21 calendar days after HCAI acceptance of Ph 1 for owner to staff, stock and license 1st room.  
  
Allow 21 calendar days after HCAI acceptance of Ph 2 for owner to staff, stock and license 2nd room.  
  
Within each phase, prior to installation of OFCI activity, allocate 14 calendar days for university to deliver OFCI equipment and install OFVI x-ray equipment.
- B. Equipment Coordination: Contractor and University supplied equipment will require complete installation data be exchanged directly between Contractor and vendors and subcontractors involved as progress of Project requires. Individual requesting information shall advise when it is required. Incorrect, incomplete, delayed or improperly identified equipment causing delay or error in installation will require entity causing such action to be liable for modifications or replacements necessary to provide correct and proper installation, including relocations.
- C. Contractor shall provide large scale casework and equipment drawings for casework and equipment service rough-in locations (dimensioned from building features), service characteristics, and locations of studs or blocking where such locations are critical to mounting or otherwise installing equipment and casework. Furnish sizes and spacing required for mechanical and electrical cutouts, and a complete brochure of fittings, sinks, outlets, or other information to provide a complete assemblage of the items and accessories being furnished.
- D. Interruption of Services: Construction Work shall accommodate University's use of surrounding and adjacent premises during the construction period and shall provide continuous public access and use of surrounding and adjacent facilities. Contractor shall not deny access to public use facilities until an alternate means of public use has been provided. An interruption of service is defined as any event which in any way interrupts, disrupts or otherwise discontinues, even momentarily, the services provided by University to its patients and staff. Adequate notice, as described below, shall be given to University when any interruption of services or interference with the use of existing buildings and roads are anticipated. Any interruption of service will be made only by University upon such notice. Interruptions to University services will not be made without prior notification and approval by University. Contractor shall never interrupt any University service without direct University participation.
  - 1. Dig Notification: Contractor shall complete and submit for review to University's Representative, a Dig Notification Form, included at the end of this section, and obtain written authorization from University prior to the commencement of any

- digging activities. Digging activities include exploratory demolition, soils excavation, concrete core drilling, and saw cutting. Contractor shall include all pertinent information with the Dig Notification Form and submit with detailed work plan fourteen (14) calendar days prior to desired digging activity.
2. The Contractor shall contact USA North 811 prior to starting underground Work to locate existing underground utilities.
  3. Contractor shall mark locations of all known utilities on ground of dig area with marker paint.
  4. Prior to commencement of digging activities, Contractor shall verify project inspector has inspected the dig site and confirmed the site marking as accurate, complete and in conformance with site utility plans.
  5. Contractor shall verify with University's Representative that all interested hospital departments have been notified of intent to begin digging operation.
  6. Record documents are required for dig activities. Contractor shall provide As-Built drawings.
- E. Shutdown Procedures: Contractor shall complete and submit for review and approval to University a Request for Shutdown form, included at the end of this section. Contractor shall include all pertinent information to assist University in coordination of shutdown activities. The Shutdown Request Form shall be submitted with a detailed work plan addressing the proposed shutdown not less than fourteen (14) calendar days prior to desired shutdown.
- F. The University does not normally charge for its shutdown support services. However, if poor planning and/or poor execution of a shutdown by the Contractor causes excessive time and effort for University personnel, the University reserves the right to back charge the Contractor for this effort required to support such shutdown.
1. Contractor shall verify with University's Fire Marshal that all appropriate Interim Life Safety Measures (ILSM) are in place.
  2. Contractor shall determine that proper and appropriate coordination and notification has been completed, including written authorization from University's Representative, prior to shut down.
  3. Service shutdowns shall require specific work plans to be submitted to and coordinated with University's Representative. Work Plan should reflect various work trades, activities or entities requiring active participation with University teams to coordinating hospital functions with construction activities.
    - a. Contractor shall request, schedule, and conduct a General Work Plan Meeting prior to any work activity occurrence. During this meeting Contractor and University shall produce and agree to a list of work activities, which will require digging and/or shutdown coordination and procedures.
    - b. University's Representative, upon receiving the agreed submission for coordination, shall schedule the actual digging and/or shutdown at the earliest possible date not later than fourteen (14) calendar days from

receipt of the submission. Operation of valves, switches, etc. to affect shutdowns shall be operated by University personnel only.

- c. A shutdown is defined as any interruption of services provided by University to its patients and staff.
4. Planned service shutdowns shall be accomplished during periods of minimum usage. Contractor shall plan work to restore service in minimum possible time and shall cooperate with the University to reduce number of shutdowns.
- a. Notwithstanding the provisions of Article 14.6 of the General Conditions of the Contract, Contractor may be required to perform certain types of work outside normal time periods.
    - 1) Non-normal times shall include, but not be limited to, periods of time before 7:00 a.m. and after 5:00 p.m. in the evening, weekend days, or legal holidays, or such periods of time which constitute split shifts or split working periods.
    - 2) Contractor shall include allocation of the cost of this work as part of the base bid and shall not be entitled to additional compensation as a result of such work during non-normal time periods.
    - 3) Contractor shall include the non-normal periods as distinct activities on the detailed project schedule.
    - 4) Contractor is advised and Contractor shall be prepared, at University written request, to perform certain shutdown and asbestos related work during non-normal time periods.

[Add additional specific work which is to be performed during non-normal time periods.]

- G. Utility locations: Refer to Section 017600. General location of utility lines and services may be shown on the drawings or described elsewhere, University does not warrant the accuracy of the locations shown or described. Determination of the actual on-site locations of utility lines and services prior to the commencement of work shall be the responsibility of the Contractor. Contractor shall complete layout/research for Points of Connection (P.O.C.) and clean/prep piping at P.O.C. All capping, relocation or removal of such lines and services shall be performed by Contractor as a part of the Contract. New/continued piping and services installation shall be prefabricated and in place prior to the shutdown. All materials and tools required to complete the work must be at the shutdown location(s). Contractor shall not assume existing valves will hold 100%. Contractor is required to have at least one (1) alternate method (including parts and equipment) to complete installation once shutdown has started. Note: only wheel type cutters shall be used on copper pipe to reduce contamination to existing systems/valves.



- H. Detailed Work Plans: Contractor shall develop and submit for review and approval to University's Representative detailed work plans for specific work activities, both inside and outside the work area, associated with impact to, or interruption of services and operation, and dig activities. Work Plans shall be submitted as a PDF electronic file with Table of Contents indexed. Work Plans shall include written description of work activity, detailed schedule with proposed sequence of operation and activity duration, type of equipment to be used, a copy of site plan highlighted to indicate sequencing and location of work and equipment, completed Request for Shutdown and/or Dig Notification forms as applicable, conformance to ILSM, and control methods for noise, vibration and airborne contaminants.
1. Work Plan submittal will not be accepted unless all required information is provided at time of submittal.
  2. Submit Work Plan at least fourteen (14) calendar days prior to the commencement of any associated work activities.
  3. Coordination/Engineering Drawings: Contractor shall provide a complete set of Coordination/ Engineering Drawings that indicates the architectural and structural building components; and combines all piping, conduits, fire sprinkler system, equipment, hangers, braces and other building components into one composite drawing for each floor, wing or area of work. Submit the Coordination/ Engineering Drawings as a bookmarked PDF electronic file. These drawings are for the Contractor's and University's use during construction and shall not be construed as replacing any shop drawings, "As-Builts", or record drawings required elsewhere in the Contract Documents. University's review of these drawings is for design intent only and shall not relieve the Contractor of the responsibility for coordination of all work performed per the requirements of the Contract.
    - a. Contractor shall prepare and submit complete  $\frac{1}{4}'' = 1' - 0''$  coordination drawings, including plans, sections, details as are appropriate indicating the area layout, complete with debris removal area and materials access points, and all mechanical and electrical equipment in all areas and within above and below ceiling spaces for new and existing conditions, including bottom of all ducts, plenum, pipe and conduit elevations. Drawings shall show all structural and architectural components, restraints and other obstructions that may affect the work. Electronic or photo reproduction of University's Architectural Drawings is not acceptable.
    - b. Contractor and each Subcontractor shall ensure all relevant mechanical and electrical equipment, piping, conduit, fire sprinkler system, ceiling hangers, braces etc., are shown and will fit, together with necessary items such as lights, ducts, fans, pumps, piping, conduit and the like.
    - c. Contractor shall indicate all locations of expansion/ seismic joints and indicate how expansion for piping, conduit and other components is provided.

- d. Contractor shall indicate all locations for access doors or other means of access at conditions above and below for items requiring access or service including but not limited to valves, mechanical equipment, electrical equipment valves and other components. The Contractor is responsible that piping, conduit, braces and other obstructions do not block access to items indicated above.
- e. Submit completed and fully coordinated PDF electronic indexed file drawings with bookmarked Sheet Index together with Contractor's comments indicating possible areas of conflict for review to University's Representative prior to start of work.
- f. Penetrations: Contractor shall prepare a sleeving layout (¼" scale) indicating size and locations of sleeves. Trades shall indicate to Contractor their requirements and locations. PDF electronic files to applicable trades and University's Representative.
- g. Completion of work: All coordination drawings shall be submitted together with record (as built) drawings of all trades involved in accordance with Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION**

3.01 Refer to the following attachments

- A. Request for Shutdown (RFS) Info/Impact Report
- B. Dig Notification Form

**END OF SECTION 01 31 00**

**REQUEST FOR SHUTDOWN (RFS) INFO/IMPACT REPORT**

PROJECT NAME: \_\_\_\_\_

UNIVERSITY RFS# \_\_\_\_\_

PROJECT #: \_\_\_\_\_ HCAI #: \_\_\_\_\_ CONTRACTOR RFS #: \_\_\_\_\_

TODAY'S DATE: \_\_\_\_\_ SHUTDOWN DATE: \_\_\_\_\_ SUSPEND DATE: \_\_\_\_\_

|  |  |
|--|--|
| <b>TO: UC DAVIS HEALTH</b><br>Facilities Design & Construction<br>4800 2 <sup>nd</sup> Avenue, Suite 3010<br>Sacramento, CA 95817<br>P: 916-734-7024 | <b>FROM:</b> _____<br>_____<br>_____<br>_____<br>_____ |
| <u>Project Manager's email address:</u>  | _____  |

Request Date: \_\_\_\_\_ Shutdown Target Date: \_\_\_\_\_

Requested By: \_\_\_\_\_ Requestor's Phone #: \_\_\_\_\_

Shutdown Work (Utility Specific): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Scope (Brief Description of Work): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Impact (Areas & Users): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Additional Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**DIG NOTIFICATION FORM**

PROJECT #: \_\_\_\_\_ HCAI#: \_\_\_\_\_ DATE: \_\_\_\_\_

|   |   |
|---|---|
| <b>TO: UC DAVIS HEALTH</b><br>Facilities Design & Construction<br>4800 2 <sup>nd</sup> Avenue, Suite 3010<br>Sacramento, CA 95817<br>P: 916-734-7024<br><br><u>Project Manager's email address:</u> | <b>FROM:</b><br>_____<br>_____<br>_____<br>_____<br>_____ |
|---|---|

1. Has USA been notified? YES \_\_\_ NO \_\_\_  
 When? \_\_\_\_\_
2. Are all known utilities marked? YES \_\_\_ NO \_\_\_
3. Location of dig shown on attached site plan? YES \_\_\_ NO \_\_\_  
 Purpose \_\_\_\_\_
4. Dates digging will take place \_\_\_\_\_  
 Place \_\_\_\_\_

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

| <b><u>UNIVERSITY USE ONLY</u></b>  |               |        |
|--|---------------|--------|
| Date received: _____   |               |        |
| 1. Utilities verified by IOR?  | YES ___       | NO ___ |
| 2. Dig activities coordinated with all parties?                          | YES ___       | NO ___ |
| 3. Comments: _____   |               |        |
| Date Authorized: _____   | Signed: _____ |        |
| Date Returned: _____   | Signed: _____ |        |
| Comments: (Utilities encountered, disruptions, successes, weather, etc.) |               |        |
|  |               |        |
|  |               |        |
|  |               |        |
|  |               |        |
| Copies: University _____ Consultants _____ File _____                    |               |        |

## SECTION 013200

### CONTRACT SCHEDULES

#### PART I - GENERAL

##### 1.01 SCOPE

- A. Preliminary Contract Schedule, Contract Schedule, updated Contract Schedules, Short Interval Schedules (SIS), Recovery Schedules and As Built Schedule.
- B. Sub-networks of activities (Fragnets) supporting Time Extension Requests.

##### 1.02 DEFINITIONS

- A. Construction Schedule/CPM Schedule/Schedule: The most recent; Baseline Schedule, Updated Schedule or Revised Schedule.
- B. Final Baseline Schedule: A final and ongoing Schedule for the project that has been reviewed and accredited by the University's Representative
- C. Critical Work activities are defined as Work activities that, if delayed or extended, will cause a critical delay as defined in General Conditions Article 8. All other Work activities are defined as non-critical Work activities and are considered to have float.
- D. Float is defined as the time that a non-critical Work activity can be delayed or extended without causing a critical delay as defined in General Conditions Article 8. Neither the **Contractor** nor the University shall have an exclusive right to the use of float. Float is a shared resource available to each party to the contract. The **Contractor** shall document the effect of the use of float on the updated Contract Schedule.
- E. Recovery Schedule: Schedule required when any Revised Schedule or Update Schedule shows the work to be more than 14 calendar days behind the latest University-accepted contract end date
- F. Short Interval Schedule (SIS): Schedule prepared on a weekly basis demonstrating the work accomplished the prior week and work planned for the upcoming three weeks.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 013300 Shop Drawings, Product Data, Samples:
1. Proposed Scheduling Software and qualifications of individual preparing schedules.
  2. Preliminary Contract Schedule
  3. Contract Schedule including graphical and tabular reports.
  4. Monthly Updates to Contract Schedule, including Narrative Report.
  5. Short Interval Schedules
  6. Final As-Built Schedule
- B. Include an electronic version of all submittals required by this specification, including Narrative prepared in MS Word or .pdf format, CPM schedule in .xer file (P6 backup) or other schedule native file format if accepted under 1.3. A.1 above, .pdf of full schedule, and .pdf of critical path. The following fields shall be included:
1. Activity identification
  2. Activity description
  3. Duration, start, and finish dates.
  4. Percentage of completion
  5. Total float
  6. Responsible party
  7. Predecessors and successors

**PART II - PRODUCTS**

2.01 SOFTWARE

- A. The **Contractor** shall use Primavera P6 by Oracle Corporation, or equal to produce the schedule and all required graphical and tabular reports.

## PART III - EXECUTION

### 3.01 PRELIMINARY CONTRACT SCHEDULE

- A. Within 10 calendar days after the Notice of Selection as the Apparent Lowest Responsible Bidder, **Contractor** shall submit the Preliminary Contract Schedule in both native and .pdf format to the University's Representative for acceptance. The Preliminary Contract Schedule shall represent the **Contractor's** plan for accomplishing the work within the Contract time showing all significant milestones for the Contract period as well as a detailed work plan for the first 90 calendar days following the Notice to Proceed. This detailed work plan shall identify in detail the following activities for the first 90 calendar days:
1. Preparation of equipment and material submittals for review. List Project submittals within Schedule per each specification section including Division 1 requirements. Indicate dates for submission of required submittals. Note: schedule shall include 18 calendar days for the University's review of the Preliminary Contract Schedule.
  2. Make submissions within the following number of days after the Notice to Proceed:
    - a. Items needed in initial stages of Work or requiring long lead-time for ordering: 30 calendar days.
    - b. Deferred approval submittals, for review and approval by agencies such as University's when required: 60 calendar days.
    - c. Electrical, mechanical and equipment items other than those covered by item "a" above: 60 calendar days.
    - d. All other items: 90 calendar days.
  3. Procurement schedule.
  4. Critical Path for the first 90 calendar days.
- B. The Preliminary Contract Schedule shall acknowledge significant known constraints and include all anticipated activities prior to the Notice to Proceed.
- C. The Preliminary Contract Schedule shall not include any actual dates or progress measured against any activities.
- D. Acceptance of the Preliminary Contract Schedule is a condition for approval of the first progress payment application.
- E. The **Contractor's** progress shall be measured against the Preliminary Contract Schedule until such time as the University accepts the **Contractor's** first Contract Schedule. The Preliminary Contract Schedule shall be incorporated into the **Contractor's** proposed Contract Schedule.

- F. Unless approved by the University's Representative, there shall be no activities shown with durations greater than 14 calendar days (excluding submittals, submittal reviews, and procurement activities).

3.02 CONTRACT SCHEDULE (BASELINE)

- A. The Contract Schedule shall represent a practical plan to fully complete the Contract within the Contract Time. The Contract Schedule shall include a complete sequence of construction, in adequate detail for coordination of the Work and shall be coordinated with the preparation of the Schedule of Values per 01 29 00 Measurement and Payment.

B. Form

1. The proposed first contract schedule shall be produced using CPM (Critical Path Method) techniques, in the PDM (Precedence Diagram Method) method of scheduling. The Contract Schedule shall be calculated using the Retained Logic method. Progress override calculations shall not be acceptable. The schedule shall not use negative float or constraints on work activities.
2. The Contract Schedule shall identify all holidays and non-working days.
3. Identity of the party responsible for the activity (i.e., University, General **Contractor**, specific subcontractor, etc.)
4. The Contract Schedule activities shall be coded with the following information applicable to each activity:
  - a. Area of the project
  - b. Identity of the party responsible for the activity (i.e., University, General **Contractor**, specific subcontractor...)
  - c. Specification section applicable to activity
  - d. Phase
  - e. Sequence – The following sequences shall be identified:
    - 1) Administrative
    - 2) Submittal and Review
    - 3) Fabrication
    - 4) Construction: including phasing and sequencing as identified in 011400 Work Restrictions
    - 5) Inspection, Commissioning, and Close-out



C. Content

1. The Contract Schedule shall identify all Work activities in correct sequence for the completion of the Work within the Contract Time. Work activities shall include the following:
  - a. Major **Contractor**-furnished equipment, materials, and building elements, and scheduled activities requiring submittals or University's Representative's prior acceptance.
    - 1) Show dates for the submission, review, and approval of each such submittal. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by the University.
    - 2) The schedule shall allow submittal review time in accordance with Section 013300 Shop Drawings, Product Data, Samples.
  - b. System test dates.
  - c. Scheduled overtime Work to the extent permitted by Contract Documents.
  - d. Dates **Contractor** requests designated workspaces, storage area, access, and other facilities to be provided by the University.
  - e. Dates **Contractor** requests orders and decisions from the University on designated items.
  - f. Dates **Contractor** requests University-furnished equipment.
  - g. Dates **Contractor** requests University-furnished utilities.
  - h. Planned dates for shutdown, connection and relocation of existing utilities.
  - i. Planned dates for connecting to or penetrating existing structures.
  - j. Planned dates for scheduled inspections as required by Codes, or as otherwise specified.
  - k. Commissioning Sequence and activities for all Building Systems.
2. Unless approved by the University's Representative, there shall be no activities shown with durations in excess of 7 calendar days (excluding submittals, submittal reviews, and procurement activities). Milestones should be listed for the completion of wings, floors, and other similar areas.
3. The allowable monthly rain days per the Supplemental Conditions shall be incorporated into the Schedule.
4. Identify types of calendars used and the logic of their application.

D. Submission

1. The first Contract Schedule shall be submitted to the University not later than 30 calendar days after Notice to Proceed. The period covered by Contract Schedule shall be the Contract Time as specified in the Notice to Proceed. The Contract Schedule shall incorporate the logic of the Preliminary Contract Schedule covering the first 90 calendar days following the Notice to Proceed. Items to be included with first submission:
  - a. Contract Schedule (Baseline)
  - b. Critical Path Schedule excluding all non-critical Work activities.
  - c. Narrative
2. Tabular Computer Reports
  - a. As requested by the University, the **Contractor** shall submit various computer-generated tabular reports.
  - b. As requested by the University's Representative, the **Contractor** will be required to submit additional Schedule Reports.

E. Acceptance

1. Upon receipt, the University's Representative shall review the proposed first Contract Schedule. Within 21 calendar Days of the University's receipt of the proposed first Contract Schedule, the University's Representative shall schedule a review meeting with the **Contractor** for the purpose of jointly reviewing the proposed first Contract Schedule.
2. If the proposed first Contract Schedule is accepted by the University's Representative, it shall become the Contract Schedule (or Baseline Schedule). Such acceptance shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the Contract Schedule.
3. If the **Contractor** or the University's Representative determines the proposed first Contract Schedule to need revision, the **Contractor** shall revise and resubmit the proposed first contract schedule to the University's Representative within 14 calendar days for acceptance. If accepted, it shall become the Contract Schedule. Such acceptance shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the Contract Schedule. If not accepted the **Contractor** will resubmit within 10 calendar days for a new review period to start.

- a. No progress payment beyond the second progress payment will be paid to the **Contractor** until such time as the University's Representative has approved the **Contractor's** first proposed Contract Schedule.

F. Schedule Logic

1. Activity schedule logic should normally be of Finish-to-Start relationship type and assembled to show order in which **Contractor** proposes to carry out the Work. The logic should indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials, and equipment. Form basis for assembly of schedule logic on the following criteria:
  - a. Indicate which activities must be completed before subsequent activities can be started.
  - b. Indicate which activities can be performed concurrently.
  - c. Indicate which activities must be started immediately following completed activities.
  - d. Indicate resource sequencing due to availability or space restrictions.
  - e. Lags shall not be used if can be represented with additional schedule detail. Finish-to-start logic ties with positive lags are not permitted. All positive time consumption should be represented by a schedule activity. Start-to-start, or finish-to-finish logic ties with negative lags are not permitted.
  - f. Lags in Start-to-Start or Finish-to-Finish relationships must not exceed the duration of the predecessor or successor activity, respectively.

G. Non-Sequestering of Float

1. **Contractor** shall not sequester float through scheduling techniques, including, but not limited to, constrained dates, extending Work Activity duration estimates, using preferential logic, such as lag or negative lag (lead), unless specifically requested in writing and approved by University's Representative. It is acknowledged that University-caused or **Contractor**-caused time savings to Activities on, or near, the critical path will increase float, such increase in float shall not be for the exclusive use or benefit of either University or **Contractor**.

H. Out of Sequence Logic:

1. Resolution of conflict between actual work progress and schedule logic: When out of sequence activities develop in Schedule because of actual construction progress, **Contractor** shall submit revision to schedule logic to conform to current status and direction and include reasons in schedule update Narrative.

I. Preferential Logic:

1. The intended purpose of scheduling on a construction project is to help ensure that **Contractor's** work on the project is adequately planned, tracked and managed. A construction schedule can be as simple as a list of activities, organized in a logical sequence, and time scaled. The concept of construction scheduling is to see that all activities necessary to complete the work, in accordance with the contract documents requirements, are properly planned, coordinated and managed. When **Contractor's** schedule activities are not sequenced in the most logical manner, but rather, in a manner as to create the maximum possible opportunity for University interference to claim delay or interruption, the University will reject the schedule with a request of different sequence of activities.

3.03 EXPERIENCE REQUIREMENTS

- A. **Contractor** shall designate an individual from **Contractor's** staff or a consultant who shall be responsible throughout the duration of the project for preparation of all schedules and reports as required by this specification. This individual shall also be required to attend all meetings with the University's Representative as required by this specification. The **Contractor** shall demonstrate to the satisfaction of the University that the individual or consultant has at least 3 years of experience preparing, maintaining, and administering detailed project schedules on projects of the same or similar size and complexity as this project. The **Contractor** shall also demonstrate to the satisfaction of the University that the individual or consultant is proficient in the use of the scheduling software proposed for use by the **Contractor** on this project.
- B. Within 14 calendar days after the Notice of Selection as the Apparent Lowest Responsible Bidder, **Contractor** shall provide the University with the identification, qualifications, and experience of and references for the proposed individual or consultant.

3.04 MONTHLY UPDATES

- A. After acceptance of the first proposed Contract Schedule, **Contractor** shall update the Contract Schedule monthly. The update shall reflect progress as of the end of each month. **Contractor** shall submit monthly schedule update to the University's Representative for acceptance with the draft payment application and no later than the tenth day of the following month. The updates shall be made as follows:
  1. The Monthly updates shall report progress based upon percent complete of each activity or remaining duration. Actual start dates shall be recorded for those activities that have started. Actual finish dates shall be recorded for those activities that are completed. Activities that are in progress shall reflect an actual start date and the percentage completion for the activity. Actual dates shall be clearly distinguishable from projected dates.
  2. The updated Contract Schedule shall reflect an up-to-date status of the contract work as completed, and materials furnished and in permanent place that qualify for payment.
  3. The updated Contract Schedule shall reflect Contract Time changes included in all processed change orders for the progress month and each preceding month.

- B. Within 5 calendar days after receipt of the updated Contract Schedule in conjunction with the Application for Payment, the University's Representative shall review both and determine which work and material pay items qualify for payment; the approved data will then be returned to the **Contractor** for input. Within 14 calendar days, the **Contractor** and the University's Representative shall meet to review the Construction CPM Schedule and discuss any changes required.
- C. The **Contractor** shall then revise and resubmit (if required) the Updated Contract Schedule and Application for Payment to the University's Representative for payment approval.
- D. The monthly update shall be calculated using retained logic with a required finish date specified as the current contract completion date. Progress Override calculations shall not be acceptable.
- E. No Applications for Payment will be processed, nor shall any progress payments become due until updated Contract Schedules are accepted by University's Representative. The accepted, updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis for payment during that period. Acceptance of any updated Contract Schedules shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the updated Contract Schedules.
- F. **Contractor** shall perform the Work in accordance with the updated Contract Schedule. **Contractor** may change the Contract Schedule to modify the order or method of accomplishing the Work only with prior agreement by the University.
- G. With each monthly updated Contract Schedule, the **Contractor** shall provide an accompanying narrative describing the progress anticipated during the upcoming month, critical activities, delays encountered during the prior month, delays anticipated during the upcoming month, and an audit of the Contract Time. The audit shall show current days allowed by contract, days used through the end of the month, days remaining, percent of time used to date, and percent complete as measured by cost loaded schedule, and days ahead of or behind schedule. In the event that the **Contractor** was delayed by any occurrence during the prior month, the narrative report shall include a listing of all delays that affected the critical path and shall clearly explain the impact the claimed delay(s) had on the critical path and shall include an accounting of days lost or gained.
- H. In the event the monthly update shows the **Contractor** to be behind schedule (negative float), the narrative shall include a description of actions needed to bring the project back on schedule.

### 3.05 LOOK AHEAD SCHEDULES

- A. Look Ahead Schedule is a schedule derived from the Contract Schedule (or the most current monthly update of the Contract Schedule) which indicates in detail all activities scheduled or worked on for the 1 prior weeks, and all activities scheduled to occur during the next 3 weeks.
- B. Provide detailed Look Ahead Schedules every week.
- C. Submit in 11-inch by 17-inch Gantt chart format.

- D. Look Ahead Schedule shall be generated from the then current Preliminary Contract Schedule, Contract Schedule, or updated Contract Schedule. Activities listed in the Look Ahead Schedule shall reference the activity identification or other such coding for correlation to the activities listed in the Contract Schedule.

### 3.06 TIME EXTENSION REQUEST DOCUMENTATION

- A. In the event the **Contractor** shall request an extension of Contract Time, **Contractor** shall comply with the requirements of the General Conditions, including without limitation, General Conditions Article 8. In addition to the requirements of the General Conditions, as a condition to obtaining an extension of the Contract Time, **Contractor** shall timely submit a sub-network of the events of the delay that demonstrates the impact to the activities in the **Contractor's** then current schedule, as well as the impact to the overall completion date of the project.
- B. If the University's Representative approves the extension of time, the next monthly updated Contract Schedule shall incorporate the subnetwork with the extension of time. In addition, the monthly updated Contract Schedule shall contain all changes mutually agreed upon by the **Contractor** and the University during preceding periodic reviews and all changes resulting from Change Orders and Field Orders.

### 3.07 AS BUILT SCHEDULE

- A. As a condition precedent to the release of retention, the last update of the Contract Schedule submitted shall be identified by the **Contractor** as the "As Built Schedule". The "As Built Schedule" shall be submitted when all activities are 100 percent complete. The "As Built Schedule" shall reflect the exact manner in which the project was actually constructed (including start and completion dates, activities, sequences, and logic) and shall include a statement signed by the **Contractor's** scheduler that the "As Built Schedule" accurately reflects the actual sequence and timing of the construction of the project.

### 3.08 WEATHER DAYS ALLOWANCE

- A. Should inclement weather conditions, or the conditions resulting from weather, prevent the **Contractor** from proceeding with seventy-five (75) percent of the normal labor and equipment force engaged in the current critical activity item(s), (as shown on the latest CPM Progress Schedule accepted by the University's Representative), for a period of at least five (5) hours per day toward completion of such operation or operations, and the crew is dismissed as a result thereof, it shall be a weather delay day.

- B. The expected loss of days specified in the Supplementary Conditions, item 3 "Modification of General Conditions, Article 8 – Contract Time", shall be included in a separate identifiable critical activity labeled "Weather Days Allowance" to be included as the last critical activity of the project schedule prior to substantial or final completion (whichever is contractual). The weather allowance activity shall be on, and remain on, the critical path of the project throughout the life of the project until it has been absorbed. Typically, all activity's leading to completion shall go through the weather allowance activity first. When weather days are experienced, and are approved as such by the University's Representative, the **Contractor** shall either:
1. Increase the duration of the current critical activity(ies) by the number of weather days experienced, or
  2. Add a critical activity to the schedule to reflect the occurrence of the weather day(s).
- C. The duration of the weather day allowance activity shall be reduced as weather days are experienced and included in the schedule. Any remaining weather days in the weather day allowance activity at the completion of the project shall be considered as float and shall not be for the exclusive use or benefit of either the University or **Contractor**.
- D. The **Contractor** shall not receive any additional compensation for unavoidable delays due to inclement or unsuitable weather. If all the weather allowance has been used, any additional weather delay experienced by the **Contractor** may result in a non-compensable time extension upon submission of acceptable supporting documentation to the University's Representative.

**END OF SECTION 013200**

## SECTION 013220

### CONSTRUCTION PROGRESS REPORTING

#### PART I - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Requirements and procedures for documentation of construction progress using still photographs, videos, **[Webcam]**.
  - 2. Requirements and procedures for As-built Documentation
- B. Related sections include the following:
  - 1. Division 01, Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 01, Section "Closeout Submittals."

##### 1.02 PROGRESS PHOTOS/VIDEOS

- A. Maintain a **[daily, weekly, monthly]** photographic record of the progress of the Work as outlined in Part III of this Section.
  - 1. Photographs to accompany Superintendent Daily Reports will be done on a daily basis.

##### 1.03 AS-BUILT DOCUMENTATION

- A. The Contractor shall be responsible for the maintenance and completion of As-Built Documents the following procedure shall be strictly adhered to:
  - 1. Contractor shall download and save all of the construction documents. This set of Drawings along with the Specifications, shall be kept on file available to University's Representative's until the completion of the Project.
  - 2. As the Work progresses, a complete and accurate notation of all documented changes or deviations from the Drawings and Specifications shall be recorded thereon in the As-built Documents by the Contractor. Such indications shall be neatly made and kept current.
  - 3. Do not complete Work or request inspections if such Work has been installed in locations contrary to the Drawings.



4. At the completion of the Project, Refer to Section 017800 CLOSE OUT SUBMITTALS.

**PART II - PRODUCTS – Not applicable to this section.**

**PART III - EXECUTION**

- 3.01 Contractor is required to maintain a [**daily, weekly, monthly**] digital photographic record of the progress of the Work and is to submit the photographs and video coverage as required to the University Representative. Daily Photographs are required for Superintendent Daily Reports.
- 3.02 Contractor is required to maintain the As-Built Documents on a [**daily, weekly, monthly**] basis.

**END OF SECTION 013220**

## SECTION 01 33 00

### SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Administrative requirements for shop drawings, product data and samples submittals
- B. University's and University's Consultant's review of submittals
- C. **Contractor's** review of submittals
- D. Shop Drawing Submittals
- E. Product Data submittals
- F. Sample submittals
- G. Field Samples and mock-ups
- H. Submittal Schedule requirements

##### 1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK: Subcontractor and materials suppliers list.
- B. Section 013200 – CONTRACT SCHEDULES: Submission and review of schedules and submittals.
- C. Section 014500 – QUALITY CONTROL: Test and Inspection Reports.
- D. Section 016100 - PRODUCT REQUIREMENTS
- E. Section 017700 – CLOSEOUT PROCEDURES: Occupancy/Acceptance /Final Payment Submittals.
- F. Section 017800 – CLOSEOUT SUBMITTALS: Preparation of Maintenance and Operating Data.

##### 1.03 ADMINISTRATIVE REQUIREMENTS

- A. General Submittals Review: Submittals shall be made in accordance with requirements specified herein and in individual Sections.
  - 1. Submittals shall be a communication aid between **Contractor**, University's Representative, and University's Consultant(s) by which interpretation of Contract Documents requirements may be confirmed in advance of construction.

2. Submit on all products to be used on the Project. Make all submittals through the University unless otherwise directed.
    - a. The University's Representative shall provide timely review of submittals and re-submittals.
      - 1) University's Representative shall have twenty-one (21) days from receipt to review all submittals twenty-one (21) days from receipt to review re-submittals.
      - 2) The Fire Marshal shall have twenty-eight (28) days from receipt to review all submittals twenty-eight (28) days from receipt to review re-submittals.
      - 3) University's Representative will prepare and keep a log of review time of all submittals.
  3. Substitutions shall be submitted in accordance with Section 016100 – PRODUCT REQUIREMENTS.
  4. Make submittals sufficiently in advance of construction activities to allow shipping, handling and review by the University's Representative and their consultants.
- B. University's and University's Consultants Review: University's Consultant's review will be only for general conformance with the design intent of the Contract Documents. Review of submittals is not conducted for purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the **Contractor** as required by the Contract Documents. Review actions of the University's Consultant or University shall not relieve **Contractor** from compliance with requirements of the Contract Documents. Changes shall only be authorized by separate written Change Order in accordance with the General Conditions of the Contract.
- C. Contractors Review: **Contractor** shall review, mark-up as appropriate and stamp Shop Drawings, Product Data, and Samples prior to submission. Submittal shall clearly show it has been reviewed by **Contractor** for conformance with the Contract Documents and for coordination with requirements of the Work. Notify University's Representative in writing, at time of submission, of any changes in the submittals from requirements of Contract Documents.

#### 1.04 SUBMITTAL REQUIREMENTS

- A. Prompt Submission: Submittals shall be submitted promptly in accordance with Submittal Schedule and in such sequence as to cause no delay in the Work or in the work of any separate contractor. Present information in a clear and thorough manner to aid orderly review.

- B. Preparation: Title each submittal with the University's Project Name and the University's Project number, submittal date and dates of any previous submissions. Clearly mark each copy to identify product or model.
1. Identify each item on submittal by reference to Drawing sheet number, detail, schedule, room number, assembly or equipment number, Specification number Reference Standard (such as ASTM or Fed Spec Number) and other pertinent information to clearly correlate submittal with Contract Documents.
  2. Include the names of the **Contractor**, Subcontractor, Supplier and Manufacturer.
  3. Include field dimensions, clearly identified as such to establish relationship to adjacent or critical features of the Work or materials.
  4. Include pertinent information such as performance characteristics and capacities, wiring or piping diagrams and controls, catalog numbers and similar data.
  5. Modify manufacturer's standard schematic drawings and diagrams and other diagrams to delete information not applicable to the Work. Supplement standard information to provide information specifically applicable to the Work.
  6. Identify changes from requirements of the Contract Documents.
  7. Include 8" x 3" blank space on face of submittal for review stamps.
  8. Include **Contractor's** review stamp, initialed or signed, and dated, certifying to the review of the submittal, verification of materials, field measurements, conditions, and compliance of the information within the submittal with the requirements of the Work and of the Contract Documents.
- C. Number of submittals required:
1. Product Data Submittals: Submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies.
  2. Initial/Re-submitted Shop Drawing Review(s): Submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies.
  3. Final Shop Drawing Review and Approval: After obtaining University's Representative approval of initial/re-submitted shop drawing submittals, as described in Section 1.04.C.2 above, **Contractor** shall submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies. **Contractor** is responsible for providing all approved shop drawings for its use and use by subcontractors and/or suppliers.
  4. Samples: Submit number specified. Samples shall be of sufficient size and quality to clearly illustrate the functional characteristics of the products, with integrally related parts and attachment devices, including full range of colors, textures and patterns.

- D. Identifying Submittals: Identify each submittal by Specification section number followed by a number indicating sequential submittal for that Section. Re-submittals shall use the same number as the original submittal, followed by a letter indicating sequential re-submittal. Examples:
1. 092500 – 1 First submittal for Section 092500 – Gypsum Board
  2. 092500 – 2 Second submittal for Section 092500 – Gypsum Board
  3. 092500 – 2A Re-submittal of second submittal for Section 092500 – Gypsum Board
  4. 092500 – 2B Second re-submittal of second submittal for Section 092500 – Gypsum Board
- E. Resubmission Requirements: Revise and resubmit as specified for initial submittal. Identify any Changes other than those requested. Note any departures from Contract Documents or changes in previously reviewed submittals.
- F. Grouping of Submittals: Unless otherwise specifically permitted by University's Representative, make all submittals in groups containing all associated items as described in each Specification Section. The University's Representative will reject partial submittals as incomplete.
- G. Unsolicited Submittals: Unsolicited submittals will be returned NOT REVIEWED.

#### 1.05 DISTRIBUTION

- A. Reproduce and distribute finalized copies of Shop Drawings and Product Data, to the following:
1. **Contractor's** Project site file.
  2. As-built Documents file maintained by **Contractor**.
  3. Pertinent Separate Contractors.
  4. Pertinent Subcontractors.
  5. Pertinent Supplier or Manufacturer.

#### 1.06 FIELD SAMPLES AND MOCK-UPS (If applicable or NOT USED)

- A. Erect at the project site, at a location directed by University's Representative, mock-ups to a size as specified.
1. The following mock-ups are required for this project:
  2. (\*\*CONSULTANT TO LIST\*\*)
- B. Fabricate each Sample and mock-up to be complete and fully furnished. Unless otherwise agreed, full-size complete samples will be returned and may be incorporated into field mock-ups and Work.

- C. Mock-ups shall be removed by the **Contractor** at conclusion of the Work at no additional cost to the University.

#### 1.07 SUBMITTAL SCHEDULE

- A. Submittals Schedule: refer to Section 013200 – CONTRACT SCHEDULES.
  - 1. The Submittal Schedule is a schedule for submission of Shop Drawings, Product Data and Samples by **Contractor**, and the processing and return of same by University.
  - 2. **Contractor** shall prepare the Submittal Schedule as described herein and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted to and accepted by University.
  - 3. Submittal Schedule shall be adjusted to meet needs of construction process and the Contract Schedule. Submit PDF electronic file with booked marked table of contents and/or sheet index of the Submittal Schedule after it is completed and each time it is update by **Contractor**.
  - 4. **Contractor** shall NOT begin fabrication or Work which requires submittals until the return of final reviewed and approved submittals have been received by the **Contractor**.

#### 1.08 ENVIRONMENTAL PRODUCT DECLARATIONS

- A. Contractor must comply with Buy Clean California Act requirements per California Public Contract Code, Sections 3500-3505.
- B. Contractor shall submit to Project Manager/Construction Manager current facility-specific Environmental Product Declaration for each eligible material proposed to be used on the Project.
- C. Environmental Product Declaration (EPD): Type III environmental impact label, as defined by the International Organization for Standardization (ISO) standard 14025, or similarly robust life cycle assessment methods that have uniform standards in data collection consistent with ISO standard 14025, industry acceptance, and integrity.
- D. Eligible Materials: Any of the following:
  - 1. Carbon steel rebar.
  - 2. Flat glass.
  - 3. Mineral wool board insulation.
  - 4. Structural steel.
- E. Eligible Materials installed on the Project by Contractor must comply with any standards to the extent established in the BCCA or by University, whichever is more stringent. The facility-specific global warming potential for any Eligible Materials must not exceed any existing maximum acceptable global warming potential for that material pursuant to the BCCA or by University, whichever is more stringent (“EM Standards”). The standards are published on the Department of General Services (DGS) website and updated information can be found on this link: <https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act>

- F. Contractor shall not install any eligible materials on the project before submitting a facility-specific Environmental Product Declaration for that material.
  
- G. This section shall not apply to an eligible material for a particular contract if the University determines, upon written justification published on its Internet website, that requiring those eligible materials to comply would be technically infeasible, would result in a significant increase in the project cost or a significant delay in completion, or would result in only one source or manufacturer being able to provide the type of material needed by the state.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 33 00**

## SECTION 01 34 00

### CONTRACTOR(S) EMERGENCY PROCEDURES

#### PART I - GENERAL

- 1.01 The purpose of this specification is to outline, to the Contractor, the University's policy and procedures for effective project site management of an emergency situation during the construction of projects at UC Davis Health.
- 1.02 This procedure applies to all Contractors and their subcontractors who have contractual agreements with UC Davis Health.

#### PART II - DEFINITIONS

- 2.01 Disaster – any natural or human-made event that causes major disruption such as damage to the organization's buildings or grounds from severe weather conditions, earthquakes, other natural phenomena or loss of utilities (power, water and telephones), acts of civil disobedience, accidents or emergencies within the organization or in the surrounding community.
- 2.02 Code Green – a code notifying all employees that an emergency event has occurred, and University operations will be opening the Hospital Command Center and shifting to emergency operations.
- 2.03 Code Red – Fire
- 2.04 Code White – Hazardous Material / Chemical Spill
- 2.05 Control Facility – the County of Sacramento has designated UC Davis Health as the Control Facility for Sacramento County. The Control Facility coordinates medical control of patients and victim's dispersal to hospitals in the community/region.
- 2.06 Other emergency situations include the following systems failures as outlined in the UC Davis Emergency Response Plan.
  - A. Water system failure
  - B. Telephone system failure
  - C. Fire
  - D. Electrical system failure
  - E. Security
  - F. Chemical spill
  - G. Evacuation



**PART III - PROCEDURES**

3.01 The Contractor will be issued a UC Davis Health Emergency Response Plan at the project

- A. Pre-construction meeting. This plan must be posted at the project site at all times in a visible location known to all project contractors.
- B. Contractor is directed to contact appropriate emergency personnel as outlined in the Emergency Response Plan information during an emergency.
- C. If the emergency involves an outside utility company, Contractor is to contact utility company directly. Known outside utilities located at the Sacramento campus are as follows.

1. Emergency Telephone Numbers

- a. Police Dispatch: 916-734-2555
- b. PO&M Dispatch (Electrical) 916-734-2763
- c. PG&E (Gas) 800-743-5000
- d. City of Sacramento Water 3-1-1
- e. HazMat Spill 916-734-2740

**END OF SECTION 01 34 00**





Fire Marshal's Office

4800 2nd Ave. #1200
Phone: (916) 734-3036
Fax: (916) 451-7754
hs-fireprevention@ucdavis.edu

Interim Life Safety (ILSM)

Based upon documentation received (ILSM Impact worksheet) a risk analysis of this project has been made. The impairments to life safety systems have been identified and interim measure provided as set forth below.

PROJECT TITLE: OSHPD # A/C#
ILSM START DATE: END DATE:
FIRE LIFE SAFETY DEFICENY(IES):
INTERIM MEASURE(S):

Table with 15 columns (ILSM1-ILSM15) and rows for various impairment categories like 'Construction activity or repair', 'Any impairment of a required egress', etc.

\*\* Requires inspection by The Fire Marshal's Office prior to ILSM commencement.

\*\*\* Fire Watch shall be documented and log provided to the Fire Marshal's Office at the end of each fire watch shift\*\*\*
Daily Inspection Log shall be completed by construction team daily & Fire Prevention staff weekly

INTERIM LIFE SAFETY IMPLEMENTATION MEASURES

Table with 2 columns: ILSM ID and Description of the interim life safety implementation measure.

Responsible Individual Signature:
Date:

Fire Marshal's Office Signature:
Date:





UC Davis Health  
 Fire Marshal's Office  
 4800 2<sup>nd</sup> Ave., Suite 1200  
 Sacramento, Ca 95817  
 916-734-3036  
 hs-fireprevention@ucdavis.edu  
 www.ucdmc.ucdavis.edu/fire/



## Interim Life Safety Measure (ILSM) Impact Worksheet

This form is completed by the Project Manager or Contractor or Contractor's Representative. Complete the form and submit to the Fire Marshal's Office for an evaluation of the need for an ILSM, Fire Watch, or other safety measure.

|                      |  |                     |  |
|----------------------|--|---------------------|--|
| Project Title:       |  |                     |  |
| Date of Project(s):  |  | Time of Project(s): |  |
| A/C#                 |  | OSHPD #             |  |
| Project Description: |  |                     |  |
|                      |  |                     |  |

|   | Yes                      | No                       |
|---|--------------------------|--------------------------|
| Project alters or significantly compromises exit access, exiting, or exit discharge building elements?<br>If yes, provide a floor plan showing how exiting is affected. Temporary exit and/or evacuation signs may be required. | <input type="checkbox"/> | <input type="checkbox"/> |
| Compromise of building compartmentation including fire or smoke walls, floor / ceiling assemblies, corridor walls, use area doors, or other defend in place elements?<br>If yes, describe in information.                       | <input type="checkbox"/> | <input type="checkbox"/> |
| The issue impairs the building fire alarms or sprinkler systems?  | <input type="checkbox"/> | <input type="checkbox"/> |
| The activity includes significant ignition sources such as cutting, welding, or other operations using flame or producing sparks?   | <input type="checkbox"/> | <input type="checkbox"/> |
| The activity includes large quantities of combustible materials, flammable materials, or generation of large amounts of dust and debris?  | <input type="checkbox"/> | <input type="checkbox"/> |
| Access to fire or life safety equipment affected?<br>If yes, what systems or equipment? (i.e.: fire watch, Fire Inspector, extinguisher, etc.)  | <input type="checkbox"/> | <input type="checkbox"/> |
| Are construction barriers present / required?   | <input type="checkbox"/> | <input type="checkbox"/> |



UC Davis Health  
Fire Marshal's Office  
4800 2<sup>nd</sup> Ave., Suite 1200  
Sacramento, Ca 95817  
916-734-3036  
hs-fireprevention@ucdavis.edu  
www.ucdmc.ucdavis.edu/fire/



Documentation – When ILSMs are required, the following documentation must be maintained:

- a. Training rosters
- b. Fire drill reports
- c. Monthly inspection and testing of temporary fire alarm, detection, and suppression systems
- d. Daily inspection of construction area
- e. Weekly inspection of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field offices
- f. Completed ILSM form at the job site

**Note\*** Contractor activities that pose an immediate threat to the health and safety or patients, visitors, hospital employees or construction personnel shall be discontinued immediately until the hazards are abated and corrected and the appropriate ILSM(s) are developed.

\_\_\_\_\_  
Requestor's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
UCDH Fire Marshal's Office Representative

\_\_\_\_\_  
Date

Information:

**SECTION 01 35 00**  
**SPECIAL PROCEDURES**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Interim Life Safety Measures (ILSM)
- B. Security Procedures
- C. Hazardous Materials Procedures

1.02 RELATED SECTIONS

- A. General Conditions of the Contract
- B. Section 011100 – SUMMARY OF THE WORK
- C. Section 013100 – COORDINATION
- D. Section 013200 – CONTRACT SCHEDULES
- E. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS
- F. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- G. Section 017300 – CUTTING AND PATCHING
- H. Section 017400 – CLEANING

1.03 INTERIM LIFE SAFETY MEASURES (ILSM)

- A. ILSM Definition: Interim Life Safety Measures are those activities that are undertaken during construction, repair, and improvement operations that are established to temporarily compensate for the deficiencies caused in fire safety and protection that may be associated with such projects.
- B. Quality Assurance: Interim Life Safety Measures (ILSM) program shall comply with The Joint Commission Standards, Life Safety (LS) Section, LS.01.02.01.
  - 1. Contractor shall be responsible for setting up control procedures to adhere to ILSM Criteria Implementation Matrix and/or the ILSM Inclusion Criteria. Contractors shall notify University's Representative of anticipated and actual problems complying with ILSM.

2. Contractor shall submit proposed Fire and Life safety impairments (21) calendar days prior to implementation. Submittal of ILSM does not infer or guarantee acceptance by University. All submitted measures shall be reviewed and returned to Contractor indicating approval, approval as noted, or rejection, revision, or re-submittal requirement by University in writing no less than fourteen (15) calendar days prior to proposed implementation. If re-submittal is required, twenty-one (21) day review period from date of re-submittal will be required.
- C. Project ILSM Procedures: If a life safety code deficiency occurs, or is identified by any source, or the requirements of the current Life Safety Code are not being met; Interim Life Safety Measures must be implemented to the extent necessary to compensate for any deficient element(s) predicated on magnitude, severity, extent and duration before corrective actions are completed.

Any minor life safety code deficiency that could be corrected within 45 calendar days that is confined to a single smoke compartment or fire zone will not merit for declaring a hospital-wide ILSM(s) but would require reduction in flammable and combustible loads in the affected smoke compartment or zone as well as issuing a work order to complete the Plan For Improvement (PFI) within 45 calendar days of discovery.

The ILSM Criteria Implementation Matrix and/or the ILSM Inclusion Criteria forms completed by a University Representative are used to determine when and to what extent applicable ILSM measures as it pertains to each condition is required to be implemented. Based on the ILSM Inclusion Criteria assessment form, it may not be necessary to declare the need to implement ILSM measures under certain conditions as delineated in the form. When ILSMs are determined to be required, an ILSM Implementation Matrix shall be utilized by the contractor.

ILSMs must be implemented upon project development and must be continuously enforced through project completion. A comprehensive plan of correction is to be developed by the Project Representative, or designee using the ILSM Evaluation Form.

- D. Any impairment or shutdown of a passive or active fire and life safety device/system for a period of 4 hours or longer in a 24 hour period will require implementation of an ILSM. Some of the most common impairments are outlined below. The listing of these ILSM examples is not intended to limit or preclude preventative actions that may be required to temporarily compensate for other life safety deficiencies that may arise during construction activities due to unforeseen conditions, the contractor's changing work plan, or required continuing activities of University. Comments following each ILSM are known ILSM requirements at time of bid. These comments are made to assist Contractor in bid preparation and later preparation of ILSM plan for the Project. University makes no guarantee these comments address all conditions requiring action by Contractor.
1. ILSM example #1: Ensure exits provide free and unobstructed egress. Maintain free and unobstructed access and exits from all buildings to public ways. Maintain escape facilities for construction workers at all times. Inspect means of egress in construction areas daily.
  2. ILSM example #2: Maintain free and unobstructed access to emergency departments/services.
  3. ILSM example #3: Ensure fire alarm, detection, and suppression systems are not impaired.



4. ILSM example #4: Ensure temporary construction partitions are smoke tight and built of noncombustible or limit combustible material that will not contribute to the
5. ILSM example #5: Provide additional firefighting equipment and use training for construction workers.
6. ILSM example #6: No smoking. Contractor shall follow the Universities smoking policy.
7. ILSM example #7: Develop and enforce storage, housekeeping, and debris removal practices that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operations.
8. ILSM example #8: Conduct a minimum of two (2) fire drills per shift per quarter.
9. ILSM example #9: Conduct regular hazard surveillance of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field office.
10. ILSM example #10: Train personnel when structural or compartmentalization features compromise fire safety measures.
11. ILSM example #11: Conduct organization-wide safety education programs to ensure awareness of any LSC (Life Safety Control) deficiencies, construction hazards, and ILSM.

#### 1.04 SECURITY PROCEDURES

- A. Security Program: Protect Work, existing premises, and University operations from theft, vandalism, and unauthorized entry.
  1. Security of the area shall be strictly maintained. Contractor shall control entrance of persons and vehicles related to University operations.
- B. Entry Control: Restrict entry of persons and vehicles into Project site and existing facilities. Allow entrance only to authorized persons with proper identification. Maintain log of workers and visitors, make available to University's Representative.
  1. Contractor shall control entrance of persons and vehicles related to University operations.
- C. Personnel Identification: Provide identification card to each person authorized to enter premises, showing: Personal photograph, name and assigned number, expiration date, and employer. Maintain a list of accredited persons; submit copy to University's Representative on request.
- D. Miscellaneous Restrictions: Do not allow cameras on site; do not allow photographs except with written approval of University.

1.05 HAZARDOUS MATERIALS PROCEDURES

- A. Except as otherwise specified, should Contractor encounter site materials, reasonably believed to be asbestos, polychlorinated biphenyl (PCB), radioactive material, lead in paint, lead lining in walls or glass windows, lead in ceramic products, mold, water leaks or other hazardous materials or conditions, the Contractor shall immediately stop work in the affected area and report the condition to University's Representative in writing. The work in the affected area shall not thereafter be resumed except by written agreement of University and Contractor if in fact the material is identified as hazardous and has not been rendered harmless. The work in the affected area shall be resumed in the absence of hazardous materials, or when such materials have been rendered harmless.
  
- A. Spills, discharges, overruns, or similar occurrences involving hazardous materials on site shall be promptly reported in writing to University's Representative. If Contractor fails to notify University in a prompt and timely manner of an occurrence, University will contract with licensed hazardous materials abatement contractor to clean up the hazardous material. Contractor shall pay all costs of removal, including financial penalties incurred, the result of the Contractor's failure to act promptly in response to the product emergency.
  
- C. Contractor shall provide means and personnel to contain and control product emergencies or shall provide means and methods to render hazardous materials harmless.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 35 00**

**SECTION 013900**  
**GREEN BUILDING POLICY IMPLEMENTATION**

**PART I – GENERAL**

1.01 SECTION INCLUDES

- A. Fundamental Building Systems Commissioning
- B. Construction Waste Management: Divert 80% from Landfill
- C. Construction Indoor Air Quality (IAQ) Management Plan: During Construction

1.02 RELATED DOCUMENTS AND SECTIONS

- A. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES and CONTROLS
- B. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- C. Section 016100 – PRODUCT REQUIREMENTS
- D. Section 017400 – CLEANING
- E. Section 017500 – STARTING and ADJUSTING SYSTEMS
- F. Section 017600 – PROTECTING INSTALLED CONSTRUCTION
- G. Section 017700 – CLOSEOUT PROCEDURES
- H. Section 017800 – CLOSEOUT SUBMITTALS
- I. Section 018100 – PLUMBING/HVAC TESTING PROCEDURES
- J. Section 018200 – DEMONSTRATION and TRAINING
- K. Section 027250 – STORM DRAINAGE WATER QUALITY
- L. Section 142400 – HYDRAULIC ELEVATORS
- M. Section 145800 – PNEUMATIC TUBE SYSTEMS
- N. Division 21 – WET SPRINKLER SYSTEMS
- O. Division 22 – PLUMBING WORK
- P. Division 23 – MECHANICAL WORK (All)
- Q. Division 26 – ELECTRICAL WORK (All)
- R. Division 33 – SITE UTILITIES

### 1.03 FUNDAMENTAL BUILDING SYSTEMS COMMISSIONING

- A. Commissioning is a systematic process of ensuring that all building systems and assemblies perform interactively according to University objectives and requirements and the design according to the contract documents. The commissioning process encompasses and coordinates the traditionally separate functions of system documentation, equipment start-up, control system calibration, systems testing, testing and balancing, and training. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product. Commissioning during construction is intended to achieve the following specific objectives:
1. Ensure that applicable equipment, systems, and assemblies are installed according to the manufacturer's recommendations and to accepted industry standards, and that they receive adequate operational checkout by the Contractor.
  2. Ensure and document that equipment, systems, and assemblies' function and perform according to University objectives and requirements and the Contract Documents.
  3. Ensure that operations and maintenance (O&M) manuals are complete.
  4. Ensure that University operating and maintenance personnel for all systems are adequately trained.
- B. Commissioning will be performed under the authority and management of the University Plant Operations & Maintenance Department (PO&M), as an independent organization whose individuals are not directly responsible for project design or construction management.
- C. Contractor Commissioning Responsibilities
1. Designate a Commissioning Coordinator to organize, schedule, and coordinate the execution of Contractor and subcontractor commissioning responsibilities.
  2. Ensure that commissioning activities and durations including predecessors' activities completed prior to the start of commissioning activities, are represented in the contract schedule.
  3. Notify the University when system testing for mechanical and electrical items, installations, and equipment per mechanical and electrical specifications will be conducted.
  4. Provide all labor, materials, and subcontractor support required for system testing and commissioning to the University.
  5. Attend and participate in commissioning planning and other associated meetings to facilitate the commissioning process.
  6. Provide additional documentation prior to normal O&M manual submittals to the University for development of installation, start-up, and testing procedures.

7. Assist in clarifying the operation and control of commissioned equipment or assemblies in areas where the specifications, control drawings, or equipment documentation is not sufficient preparing testing procedures.
8. Review test procedures developed by the University to ensure feasibility, safety, and equipment protection.
9. Verify that all equipment to be tested or commissioned is installed correctly, anchored correctly, electrical, wiring & breakers are the correct size for the equipment and all other utilities required are installed.
10. Execute testing for selected systems and assemblies under the direction of the University.
11. For work that did not pass testing or commissioning evaluate, identify, make repairs or corrections so not to delay the testing or commissioning process. Update the schedules with the revised commission activities.
12. Ensure that the local authorities having jurisdiction are present to witness any acceptance testing of systems that are a condition of building occupancy (fire alarm, fire damper, sprinkler system, etc.).
13. Train University personnel and prepare O&M manuals in accordance with the Contract Documents.

1.04 CONSTRUCTION WASTE MANAGEMENT: DIVERT 80% FROM LANDFILL

- A. Landfill Diversion Requirement: Divert 80% minimum of total project waste from landfill.
- B. Storage bins
- C. Submittals
  1. Waste Management Plan (WMP): Provide the following information:
    - a. Waste Material Estimating Sheet (Appendix A at the end of this Section): Project title, name of company which will implement the plan, and date.
    - b. Estimated job site waste to be generated, including types and quantities.
    - c. Proposed Alternatives to Landfilling: List each material planned to be salvaged or recycled, including quantities and proposed destination.

2. Waste Management Progress Reports: Submit the following information to the University's Sustainability Administrator on a monthly basis (for example: information for June is due by July 20):
  - a. Waste Management Log (Appendix B at the end of this Section):
  - b. Project title, name of company completing report and dates of period covered by the report.
  - c. Date, destination, and quantity of each type of material landfilled, salvaged or recycled.
  - d. Weighmaster tickets can be substituted for items a and c (except for salvaged items). In all instances, weighmaster tickets must be provided with this submittal.
  - e. Alternative report formats may be acceptable but must be reviewed and approved by the University's Sustainability Administrator before being used in lieu of the requirements above.
3. Legible copies of manifests, weight tickets, and receipts. Manifests shall be from recycling and/or disposal site operators that can legally accept the materials for the purpose of reuse, recycling or disposal.
4. Maintain at the Project site Waste Management Logs for each load of materials removed from site.

D. PROJECT MEETINGS

1. Discuss Waste management plans and implementation at the following meetings:
  - a. Pre-construction meeting.
  - b. Regular job-site meetings.

E. PROJECT CONDITIONS

1. Hazardous materials are excluded from the work of this Section. If hazardous materials are encountered or suspected, stop work in the suspect area. Refer to Section 013500 Special Procedures.

F. CONSTRUCTION WASTE RECYCLING SERVICES

1. Construction waste recycling services for materials shall be those proposed by the Contractor and approved by the University.

G. The following may be suitable for diversion from landfill, though the Contractor and Contractor recyclers are responsible for final determination of suitable materials.

1. Concrete: Clean concrete, concrete with rebar, asphalt concrete.
2. Metals: Steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass or bronze, including banding, ductwork, framing, roofing and siding, flashing, piping and rebar.

3. Aggregate.
4. Wood: Clean dimensional wood, wood pallets, engineered wood products including plywood, particleboard, I joists.
5. Vegetation.
6. Cardboard, paper, packaging.
7. Masonry: Brick, ceramic tile, CMU.
8. Gypsum board.
9. Acoustic ceiling panels.
10. Carpet and pad.
11. Paint.
12. Insulation.
13. Plastics: ABS, PVC
14. Beverage containers

H. WASTE MANAGEMENT PLAN IMPLEMENTATION

1. Coordinate waste materials handling and separation for all trades.
2. Document results of the implementation of the Waste Management Plan.
3. Provide separation bins for temporary onsite storage, handling, transportation, recycling, salvage, and landfilling for all demolition and waste materials.
4. Keep recycling and waste bins areas neat, clean and clearly marked in order to avoid contamination or mixing materials.
5. Maintain logs onsite for each load of materials removed from site.

1.05 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN: DURING CONSTRUCTION

- A. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building including:
1. Meet or exceed the recommended design guidelines of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines, 1995, Chapter 3. Compliance with SMACNA Guidelines shall start no later than the scheduled HVAC startup date. SMACNA Guidelines for HVAC protection and for protection of absorptive materials may need to start at an earlier stage, in accordance with the construction schedule.
  2. Protect stored on-site or installed absorptive materials from moisture damage.
  3. Comply with requirements in Division 23 for Ductwork.

- B. Develop and implement an Indoor Air Quality Management Plan for the pre-occupancy phase.
  - 1. Comply with requirements of in Division 23 for Ductwork.
- C. Submittals
  - 1. Construction Indoor Air Quality Management Plan.
    - a. Submit documentation demonstrating that an Indoor Air Quality Management Plan was developed and implemented, including:
      - 2. SMACNA IAQ Guidelines Chapter 3 implementation.
      - 3. Stored on-site or installed abortive materials were successfully protected from moisture damage.
      - 4. Maintaining ductwork internal cleanliness.
      - 5. Documentation including product data, that if any air handling systems were used during construction, that any return and exhaust grilles were protected with filtration media with a Minimum Efficiency Reporting Value (MERV) of at least 13 (per ASHRAE 52.2) including filtration media manufacturer's name, model number, and MERV value.
      - 6. Documentation, including product data, that all filtration media was replaced prior to occupancy with filtration media with a Minimum Efficiency Reporting Value (MERV) of at least 13 (per ASHRAE 52.2) including filtration media manufacture's name, model number, and MERV Value.
      - 7. Provide photographs verifying plan compliance at different phases of construction.
      - 8. Submit documentation that a minimum two weeks building 100% outside air flush-out was completed, including dates when the flush-out was begun and completed and what steps were taken to guarantee 100% outside air usage.
      - 9. Submit documentation for the filtration media used during the flush-out period, including filtration media manufacturer's name, model number, and MERV value.
- D. Implementation
  - 1. HVAC Protection
    - a. Comply with Section in Division 23 for Ductwork



2. Source Control

- a. Prefabricated insulated ductwork and insulating materials should be protected against moisture. Ductwork materials shall be stored in a dry and clean environment pending installation.
- b. Containers of wet products shall be kept closed when not used. Waste materials that can release odor or dust shall be covered or sealed.

3. Housekeeping

- a. Minimize accumulation of dust fumes, vapors, or gases upon HVAC start up.
- b. Do not run the HVAC system until after dust generating finishes, such as spray applied fireproofing and gypsum board, have been installed.
- c. Suppress dust with wetting agents or sweeping compounds. Efficient and effective dust collecting methods such as damp cloths, wet mops, and vacuum with particulate filters, or wet scrubbers shall be used.
- d. Increase the cleaning frequency when dust build-up is noticed.
- e. Remove spills or excess applications of solvent-containing products as soon as possible.
- f. Also refer to Division 23 - Ductwork for requirements.
- g. Water accumulated inside the building shall be removed promptly. Porous materials such as insulation, ceiling tiles, gypsum wall board, carpet and fabric furnishings shall be protected from exposure to moisture.
- h. Store volatile liquids, including fuels and solvents in closed containers and outside of the building when not in use.

4. Scheduling

- a. When possible, install carpets, furnishings and highly absorbent materials after all VOC-emitting products have been installed and fully cured.
- b. Provide sufficient ventilation and air circulation after VOC-emitting materials are installed.
- c. New MERV 13 filters shall be installed immediately following the flush and prior to building occupation. Refer to Division 23 – Ductwork for additional requirements. Monitoring of IAQ Plan

- d. A minimum of 18 photographs, documenting the progress of the IAQ management Plan implementation, shall be taken at the following stages:
  - 1) Site delivery and storage processes
  - 2) Installation, protection, and housekeeping activities
  - 3) Commissioning, flushing, and re-filtering of HVAC systems

Enclose with each photograph a narrative identifying the date and location where the photograph was taken, and the SMACNA strategy applied.

- e. Subcontractor site coordination meetings shall be held monthly. The purpose of these meetings shall be to review the appropriate components of the IAQ Plan and to document the progress of the plan implementation. SMACNA IAQ Guidelines Appendix C shall be used as the Planning Checklist and Appendix D shall be used as the Inspection Checklist by the subcontractor.

5. Building Flush-Out

- a. Building flush-out and report: The subcontractor shall conduct a building flush-out and prepare a flush-out report. The flush-out report should include:
  - 1) Total days required, and actual days conducted.
  - 2) Hours per day required actual hours conducted.
  - 3) Outside air percentage recommended and actual used.

**PART II – PRODUCTS – Not Applicable to this section**

**PART III – EXECUTION**

3.01 Refer to the following attachments

- A. Appendix A: Waste Materials Estimating
- B. Appendix B: Waste Management Log"

**END OF SECTION 013900**

**APPENDIX A**  
**WASTE MATERIALS ESTIMATING SHEET**  
*(Use as many sheets as needed)*

**PROJECT TITLE:** \_\_\_\_\_

**COMPANY:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

|               |             | TOTAL AMOUNT<br>GENERATED | AMOUNT<br>RECYCLED | AMOUNT<br>SALVAGED | AMOUNT<br>LANDFILLED |
|---------------|-------------|---------------------------|--------------------|--------------------|----------------------|
| MATERIAL      | DESTINATION | TONS                      | TONS               | TONS               | TONS                 |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
|               |             |                           |                    |                    |                      |
| <b>TOTALS</b> |             |                           |                    |                    |                      |

**APPENDIX B**  
**WASTE MANAGEMENT LOG**  
 (Use as many sheets as needed)

PROJECT TITLE: \_\_\_\_\_  
 COMPANY: \_\_\_\_\_  
 LOG DATES: \_\_\_\_\_ through \_\_\_\_\_

| Date          | Material | Destination | Tons     |          |            |       |
|---------------|----------|-------------|----------|----------|------------|-------|
|               |          |             | Salvaged | Recycled | Landfilled | Total |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
|               |          |             |          |          |            |       |
| <b>Totals</b> |          |             |          |          |            |       |

*Note: provide weighmaster tickets with specific information on type of material recycled and weight.*

**SECTION 01 41 00**  
**REGULATORY REQUIREMENTS**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Relationship between Code, Ordinances, Standards and Contract Documents
- B. Applicable Codes, Laws and Ordinances
- C. Project Inspections
- D. California State Fire Marshal Requirements
- E. Department of Health Care Access and Information Projects

1.02 RELATED SECTIONS

- A. Section 013500 – SPECIAL PROCEDURES
- B. Section 014200 – REFERENCES
- C. Section 014500 – QUALITY CONTROL

1.03 RELATIONSHIP BETWEEN CODES, ORDINANCES, STANDARDS AND THE CONTRACT DOCUMENTS

- A. Authority: All codes, ordinances and standards referenced in Contract Documents shall have full force and effect as though printed in their entirety in the Contract Specifications.
- B. Precedence:
  - 1. Where specified requirements differ from requirements of applicable codes, ordinances and standards, the more stringent requirements shall take precedence.
  - 2. Where Contract Drawings or Contract Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, the Contract Drawings and Contract Specifications shall take precedence so long as such increase is legal.
  - 3. Where no requirements are identified in Contract Documents, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.

---

1.04 APPLICABLE CODES, LAWS AND ORDINANCES

A. Building Codes, Laws, and Regulations:

1. Work shall meet or exceed the requirements of and be performed in accordance with applicable, adopted code requirements, laws and requirements of all other regulatory agencies, including, but not limited to the following:

- a. California Code Series - 2019 Edition

- 1) California Administrative Code, California Code of Regulations – Title 24, Part 1
- 2) California Building Code, California Code of Regulations – Title 24, Part 2, Volume 1& 2
- 3) California Electrical Code, California Code of Regulations – Title 24, Part 3
- 4) California Mechanical Code, California Code of Regulations – Title 24, Part 4
- 5) California Plumbing Code, California Code of Regulations – Title 24, Part 5
- 6) California Energy Code, California Code of Regulations – Title 24, Part 6
- 7) Elevator Safety Construction Code, California Code of Regulations – Title 24, Part 7
- 8) California Historical Building Code, California Code of Regulations – Title 24, Part 8
- 9) California Fire Code, California Code of Regulations – Title 24, Part 9
- 10) California Existing Building Code, California Code of Regulations – Title 24, Part 10
- 11) California Referenced Standards Code, California Code of Regulations – Title 24, Part 12

- b. NFPA Code Series. National Fire Protection Association (NFPA) (as adopted by State agencies)

- 1) NFPA 13 – Standard for the Installation of Sprinkler Systems.
- 2) NFPA 14 – Standard for the Installation of Standpipe and Hose System
- 3) NFPA 72 – National Fire Alarm and Signaling Code
- 4) NFPA 80 – Standard for Fire Doors and Other Opening Protectives

- 5) NFPA 99 – Health Care Facilities Code
  - 6) NFPA 101 – Life Safety Code
  - 7) NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
  - 8) NFPA 701 – Standard Methods of Fire Tests of Flame Propagation of Textiles and Films
- c. California Code of Regulation Series (embodied in California model codes as noted above)
- 1) Title 8, Industrial Relations
  - 2) Title 17, Public Health (Chapter 7)
  - 3) Title 19, Public Safety
  - 4) Title 21, Public Works
  - 5) Title 22, Social Security
  - 6) Title 24, Parts 1, 2, 3, 4, 5, 9 and 12
  - 7) Title 25, Energy Insulation Standards
- d. Americans with Disabilities Act (ADA) 2010 (Federal Law)
- e. Rules and regulations of private and public utilities
- f. American National Standards Institute (ANSI)
- g. American Society of Testing Materials (ASTM)
- h. Federal Specifications (Fed. Spec.)
- i. Underwriters Laboratories
- j. Traffic controls per California MUTCD requirements
2. All dates to comply with editions adopted and accepted by University and California State Fire Marshal (CSFM).
3. Unless otherwise specified, specific references to codes, regulations, standards, manufacturers' instructions, or requirements of regulatory agencies, when used to specify requirements for materials or design elements, shall mean the latest edition of each in effect at the date of submission of bids, or the date of the Change Order, as applicable.

4. References on Drawings or in Specifications to "code" or "building code" not otherwise identified shall mean the codes specified above, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction having authority over the project.
- B. Other Applicable Laws, Ordinances and Regulations:
1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of Federal, State and local governmental agencies and jurisdictions having authority over the Project.
  2. Work shall be accomplished in conformance with all regulations of Public Utilities and utility districts.
  3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to Contract Time or Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to execution date of the Agreement.
  4. General Contractor shall not self-perform specialty contracting work defined in sections 7055 – 7059.1 of the California Business and Professions Code unless the General Contractor has the specialty contractor's license appropriate for the work performed. Otherwise, specialty contractors shall be retained by the Contractor contractor to perform specialty work identified in the project scope.

#### 1.05 PROJECT INSPECTIONS

- A. Provision of inspectors by University, if any, or by Department of Health Care Access and Information pursuant to this Section and Section 1.04 above shall be subject to the following:
1. Contractor shall allow inspectors full access to Project at all times.
  2. Contractor shall not take any direction, approvals or disapprovals from inspectors.
  3. Contractor shall not rely on inspectors to ensure Work is completed in accordance with Contract Documents.
  4. Acts of omissions of any inspector (including without limitation inspector's failure to observe or report deficiencies in Contractor's Work) shall not relieve Contractor for responsibility to complete Work in accordance with Contract Documents.



1.06 DEPARTMENT OF HEALTH CARE ACCESS AND INFORMATION PROJECTS

- A. Department of Health Care Access and Information (HCAI) is the agency having jurisdiction over all acute care medical project design and construction unless a Memorandum of Understanding (MOU) has been established assigning University staff to perform regulatory duties.
- B. HCAI will approve an inspector for the Project who shall have full access to the Project at all times.
- C. HCAI will require Verified Report forms to be filed per testing, inspection and observation form during construction and a final verified report at completion of the project. Separate verified reports are required from Consultants, Project Inspector, and Contractor.
- D. HCAI will require a Building Permit for project submitted by University's Representative. No HCAI Building Permit fees are required to be paid by the Contractor.
- E. HCAI will require Change Order Approval submitted by University's Representative.
- F. HCAI will require a Licensed Contractor's Declaration from the Contractor.
- G. HCAI projects shall comply with the 2016 California Administration Code.

1.07 DEFERRED APPROVAL

- A. Where noted in the Contract Documents, certain items of materials and/or systems may require HCAI/CSFM deferred approval pending submittals of shop drawings. For these items, Contractor shall submit details and structural calculations for anchorage, to comply with State of California Code of Regulations Title 24, table T17-23-J. Calculations shall be made by a licensed Structural Engineer registered in the State of California.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 41 00**

## SECTION 014200

### REFERENCES

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Definitions and terms used in Contract Documents
- B. Reference Standards used in Contract Documents
- C. Common abbreviations and acronyms which may be used in Contract Documents

##### 1.02 RELATED SECTIONS

- A. Section 014100 – Regulatory Requirements

##### 1.03 DEFINITIONS OF TERMS

- A. Basic Contract Definitions: Words and terms governing the Work are defined in the General Conditions of the Contract, provided in the Contract Documents.
- B. Additional words and terms are used in the Drawings and Specifications and are defined as follows:
  - 1. Applicable: As appropriate for the particular condition, circumstance or situation.
  - 2. Approve (d): Used in conjunction with action on submittals, applications, and requests, is limited to duties and responsibilities stated in the General Conditions. Approvals shall only be valid if obtained in writing and shall not apply to matters regarding the means, methods, techniques, sequences and procedures of construction. Approval shall not release Contractor from responsibility to fulfill Contract requirements.
  - 3. And/or: If used, shall mean that either or both items so joined are required.
  - 4. By others: Work on the project that is outside the scope of Work to be performed under the Contract, but that will be performed by University, separate contractors or other means.
  - 5. Contractor-Furnished/University-Installed (CFUI): Items, systems or equipment purchased by the Contractor as part of the project and handed over to the University for installation.
  - 6. Construction Site: Same as site.

7. Directed: As instructed by University or University's Representative, in writing, regarding matters other than the means, methods, techniques, sequences and procedures of construction. Terms such as "directed", "requested", "authorized", "selected", approved", "required", and "permitted" mean "directed by University's Representative", requested by University's Consultant" or University's Representative and similar phrases. No implied meaning shall be interpreted to extend the University's Representative responsibility into Contractor's supervision of construction.
8. Equal or Equivalent: As determined by the University's Consultant as being of the same quality, appearance, utility, durability, finish, function, suitability, and performance.
9. Furnish: Means "supply and deliver, ready for unloading, unpacking, assembly, installation, and similar operations".
10. Indicated: Refers to graphic representations, notes or schedules on Drawings, or Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used, it is to help locate the reference.
11. Install: Describes operations at the site including unloading, unpacking, assembly, erection, anchoring, applying, working to dimension, protecting, cleaning, and similar operations.
12. Installer: "Installer" is the Contractor or an entity engaged by the Contractor, as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
  - a. Experienced Installer: The term "experienced", when used with "installer" means having a minimum of five (5) previous Projects similar in size to this Project, and familiar with the precautions required, and with requirements of the authority having jurisdiction.
13. Jobsite: Same as site.
14. Necessary: as determined in the professional judgement of the University Representative through the University's Consultant as being necessary for the Work, in conformance with the requirements of the Contract Documents, and excluding matters regarding the means, methods, techniques, sequences and procedures of construction.
15. Noted: Same as indicated.
16. Owner-Furnished/Contractor-Installed (UFCI): Item, system or equipment furnished by University at its cost and installed by the Contractor as part of the Work.
17. Per: In accordance with or in compliance with.
18. Products: Materials, systems or equipment.
19. Project site: Same as site.

20. Proper: As determined by the University's Representative as being proper for the Work, excluding matters regarding the means, methods, techniques, sequences and procedures of construction, which are solely the Contractor's responsibility to determine.
21. Provide: Means "furnish and install, complete and ready for use".
22. Regulation: Includes 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, whether lawfully imposed by authorities having jurisdiction or not.
23. Required:
  - a. As required by regulatory requirements of governing authorities.
  - b. As required by referenced standards.
  - c. As required by existing job conditions.
  - d. As generally provided by accepted construction practices of the locale.
  - e. As indicated on the Drawings and in the Specifications.
  - f. As otherwise required by the Contract Documents.
24. Scheduled: Same as indicated.
25. Selected: As selected by University's Representative or University's Consultant from the full national product selection of the manufacturer, unless otherwise specifically limited in the Contract Documents to a particular quality, color, texture or price range.
26. Shown: Same as indicated.
27. Site: Same as Site of the Work or Project Site; the area or areas or spaces occupied by the Project and including adjacent areas and other related areas occupied or used by the Contractor for construction activities, either exclusively or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
28. Testing Laboratories: Same as Testing and Inspection Agency.
29. Testing and Inspection Agency: An independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.
30. University-Furnished/Contractor-Installed (UFCI): Same as Owner-Furnished/Contractor-Installed.

#### 1.04 REFERENCE STANDARDS

- A. References: The Drawings and Specifications contain references to various standards, standard specifications, codes, practices and requirements for products, execution, tests, and inspections. These reference standards are published and issued by the agencies, associations, organizations and societies listed in this Section or identified in individual Sections of the Specifications.
- B. Relationship to Drawings and Specifications: Such references are incorporated into and made a part of the Drawings and Specifications to the extent applicable.
- C. Referenced grades, Classes and Types: Where an alternative or optional grade, class or type of product or execution is included in a reference but is not identified in the Drawings or Specifications, provide the highest, best and greatest of the alternatives or options for the intended use and prevailing conditions.
- D. Copies of Reference Standards:
  - 1. Reference standards are not furnished with the Drawings and Specifications. It is the responsibility of the Contractor, subcontractors, manufacturers, suppliers, trades and crafts to be familiar with these generally recognized standards of the construction industry.
- E. Jobsite Copies:
  - 1. Contractor shall obtain and maintain at the Project site copies of reference standards identified on the Drawings and in the Specifications in order to properly execute the Work.
- F. Edition Date of References:
  - 1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition or latest revision published as of the date of the Contract.
  - 2. All amendments, changes, errata, and supplements as of the effective date shall be included.
- G. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision or amendment. It is the responsibility of the Contractor to be familiar with and have access to these nationally, and industry recognized specifications and standards.

#### 1.05 ABBREVIATIONS & ACRONYMS

- A. Abbreviations and Names: Where acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction or other entity applicable.
- B. Refer also to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

C. The following are commonly used abbreviations which may be found on Contract Drawings and in Contract Specifications:

|          |  |
|----------|--|
| AA       | Aluminum Association   |
| AAA      | American Arbitration Association   |
| AAC      | Architectural Anodizers Council  |
| AABC     | Associated Air Balance Council   |
| AAMA     | American Architectural Manufacturers Association                           |
| AASHTO   | American Association of State Highway and Transportation Officials         |
| ACI      | American Concrete Institute  |
| ACPA     | American Concrete Pipe Association   |
| ACPA     | American Concrete Pumping Association                                      |
| ADA      | Americans with Disabilities Act  |
| ADC      | Air Diffusion Council  |
| AFSA     | American Fire Sprinkler Association  |
| AGA      | American Galvanizers Association (formerly AHDGA)                          |
| AGA      | American Gas Association   |
| AGC      | Associated General Contractors of American                                 |
| AI       | Asphalt Institute  |
| AIA      | American Institute of Architects   |
| AIMA     | Acoustical and Insulation Materials Association                            |
| AISC     | American Institute of Steel Construction                                   |
| AISI     | American Iron and Steel Institute  |
| AMCA     | Air Movement and Control Association International                         |
| ANSI     | American National Standards Institute                                      |
| APA      | Engineered Wood Association (formerly American Plywood Association)        |
| APWA     | American Public Works Association  |
| ARMA     | Asphalt Roofing Manufacturers Association                                  |
| ASAC     | American Subcontractors Association of America                             |
| ASCE     | American Society of Civil Engineers  |
| ASHRAE   | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |
| ASLA     | American Society of Landscape Architects                                   |
| ASME     | American Society of Mechanical Engineers                                   |
| ASNT     | American Society for Nondestructive Testing                                |
| ASPE     | American Society of Plumbing Engineers                                     |
| ASTM     | American Society for Testing and Materials                                 |
| AWI      | Architectural Woodwork Institute   |
| AWPA     | American Wood Preservers' Association                                      |
| AWS      | American Welding Society   |
| AWWA     | American Water Works Association   |
| BHMA     | Builders Hardware Manufacturers Association                                |
| BOC      | Board of Corrections   |
| CABO     | Council of American Building Officials                                     |
| CAC      | California Administrative Code (see California Code of Regulations (CCR))  |
| CAL/OSHA | State of California Construction Safety Orders                             |
| CBC      | California Building Code   |
| CCR      | California Code of Regulations   |
| CEC      | California Electrical Code   |
| CFC      | California Fire Code   |
| CFR      | Code of Federal Regulations  |
| CIMA     | Construction Industry Manufacturers Association                            |
| CISPI    | Cast Iron Soil Pipe Institute  |
| CLFMI    | Chain Link Fence Manufacturers' Institute                                  |
| CMC      | California Mechanical Code   |
| CPC      | California Plumbing Code   |
| CRSI     | Concrete Reinforcing Steel Institute                                       |
| CSI      | Construction Specifications Institute                                      |
| CTIOA    | Ceramic Tile Institute of America, Inc.                                    |
| DHI      | Door and Hardware Institute  |
| DSA      | Division of the State Architect  |
| EJMA     | Expansion Joint Manufacturers Association                                  |
| FGMA     | Flat Glass Marketing Association   |
| FM       | Factory Mutual Research Organization                                       |
| FS       | Federal Specification (from GSA)   |
| GA       | Gypsum Association   |
| GSA      | General Services Administration  |
| HCAI     | Department of Health Care Access and Information (State of California)     |
| IAPMO    | International Association of Plumbing and Mechanical Officials             |
| IEEE     | Institute of Electrical and Electronics Engineers, Inc.                    |

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|        |   |
|--------|---|
| ISO    | International Organization for Standardization  |
| MIA    | Masonry Institute of America  |
| ML/SFA | Metal Lath/Steel Framing Association  |
| MM     | State of California, Business and Transportation Agency, Department of Transportation, "Materials Manual" |
| MSS    | Manufacturers Standardization Society of the Valve and Fittings Industry                                  |
| NAAMM  | National Association of Architectural Metal Manufacturers   |
| NEC    | National Electrical Code  |
| NECA   | National Electrical Contractors Association   |
| NEMA   | National Electrical Manufacturers Association   |
| NFC    | National Fire Code  |
| NFPA   | National Fire Protection Association  |
| NFSA   | National Fire Sprinkler Association   |
| NGA    | National Glass Association  |
| NIBS   | National Institute of Building Sciences   |
| NIST   | National Institute of Standards and Technology  |
| NPCA   | National Precast Concrete Association   |
| NRCA   | National Roofing Contractors Association  |
| NSC    | National Safety Council   |
| NSF    | National Sanitation Foundation  |
| NSPE   | National Society of Professional Engineers  |
| NTMA   | National Terrazzo and Mosaic Association  |
| NWMA   | National Woodwork Manufacturers Association   |
| OSHA   | Occupational Safety and Health Administration   |
| PCA    | Portland Cement Association   |
| PCI    | Precast/Prestressed Concrete Institute  |
| PDCA   | Painting and Decorating Contractors of America  |
| PDI    | Plumbing and Drainage Institute   |
| PS     | Product Standard (U.S. Department of Commerce)  |
| RIS    | Redwood Inspection Service  |
| SDI    | Steel Deck Institute  |
| SFM    | State Fire Marshal (California)   |
| SFPE   | Society of Fire Protection Engineers  |
| SGCC   | Safety Glazing Certification Council  |
| SIGMA  | Sealed Insulating Glass Manufacturers Association   |
| SJI    | Steel Joist Institute   |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association   |
| SSPC   | Society for Protective Coatings (Steel Structure Painting Council)  |
| SSPWC  | Standard Specifications for Public Works Construction   |
| SWRI   | Sealant, Waterproofing and Restoration Institute  |
| TCA    | Tile Council of America   |
| TJC    | The Joint Commission  |
| UBC    | Uniform Building Code   |
| UFC    | Uniform Fire Code   |
| UL     | Underwriters Laboratories, Inc.   |
| UMC    | Uniform Mechanical Code   |
| UPC    | Uniform Plumbing Code   |
| USS    | United States Standard  |
| WCLIB  | West Coast Lumber Inspection Bureau   |
| WIC    | Woodwork Institute of California  |
| WWPA   | Western Wood Products Association   |

- D. Words and terms not otherwise specifically defined in this Section or in the Contract Documents, shall be as customarily defined by trade or industry practice, by reference standard and by specialty dictionaries such as Dictionary of Architecture and Construction (Cyril M. Harris, McGraw-Hill Educational; 4<sup>th</sup> Edition, September 5, 2005).
- E. Additional abbreviations, used on the Drawings, are listed thereon.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 014200**

## SECTION 01 43 00

### MOCK-UPS

#### PART I - GENERAL

##### 1.01 MOCKUPS

- A. General mock-up requirements
  - 1. Intent of mock-up is to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials.
  - 2. Mock-ups include, but are not necessarily limited to, the following:
    - a. Exterior Assemblies, Materials, Components and Finishes
    - b. Exterior Site Materials, Components and Finishes
    - c. Interior Assemblies and Finishes
- B. Submittals: Complete required submittals prior to construction of mock-ups including but not limited to product data, samples and shop drawings as required.
- C. Contract Schedule: Include mock-up activities including administrative and procedural submittals and materials ordering and assembly on Schedule per the requirements of Section 013200 Contract Schedules. Identify every element required for each mock-up. Allow ample advance time for preparation and approval of mock-ups prior to placement of final orders for work without delay to progress or completion of the work.
- D. Workmanship
  - 1. Comply with standards specified. Provide qualified personnel to produce mock-up of specified quality.
  - 2. Assemble and erect complete assemblies, with specified attachment and anchorage devices, flashings, seals and finishes. Secure mock-ups in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.
  - 3. Provide finish to match approved samples. When required in individual Sections, install full-scale mock-up of assembly at Project site at location acceptable to the University's Representative.
- E. Approval
  - 1. Maintain approved mock-ups as standard for evaluating Work. Mock-up shall remain until approved for removal by University's Representative.
  - 2. Acceptable mock-ups shall not be retained in completed Work unless noted otherwise.



3. Remove unacceptable mock-ups. Mock-ups not incorporated into finished Work shall be removed from the site immediately as approved by the University's Representative.
4. Mock-ups shall be approved by the University's Representative in writing, as a condition precedent to approval of shop drawings for work represented by the mock-up.

## 1.02 SUMMARY

- A. Exterior Assembly Mock-ups: Provide separate freestanding exterior building mock-ups for each type of exterior wall system to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials. The **CONTRACTOR** will provide composite mock-up drawings prior to fabrication for review by the University's Building Envelope Consultant/Commissioning Agent and the University's Representative. Exterior mock-ups shall be constructed out of sequence as a part of this Contract and will not be incorporated into the final building. The mock-ups will stand through the completion of the building exterior and serve as the standard for workmanship once it has been accepted in writing by the University's Representative. Following QA and inspections the Mock-ups will be subject to water testing for moisture intrusion, as specified in 019110 Building Envelope Commissioning and each component individual Sections. Provide the following exterior building mock-ups:
1. Exterior Assemblies including but not limited to Curtain Wall, Storefront, Pre-cast, Metal Panels, Rainscreen Systems, Masonry, Tile and Stone, Portland Cement Plaster and other exterior components.
  2. Mock-ups shall include, but are not limited to, all transitions and interfaces between different materials and wall openings. Mock-ups shall include an operable window with sunshade and storefront opening, including flashings a minimum of one vertical control joint, one horizontal control joint, one horizontal expansion joint, one vertical expansion joint, one joint intersection, and a soffit corner or other horizontal elements such as awnings or sunshades.
  3. Other Exterior wall system finishes, including all transitions and interfaces between different materials and openings and will include one storefront and/or operable window assembly including sunscreens. A portion of this wall mock-up shall include the Graffiti-Resistant Coating.
- B. Exterior Site Mock-ups: Mock-ups shall show materials and workmanship to be expected in the completed Work. Make necessary revisions as required until each special finishes mock-up is accepted by the University's Representative. Accepted mock-ups will be allowed to remain in place. Provide special mock-ups of the following materials in each type and finish specified, which may include but are not limited to:
1. Landscape Cast-in-Place Concrete
  2. All Paving and Pavers
  3. Pervious Concrete Paving
  4. Aggregate Surfacing
  5. Concrete Unit Masonry

6. Roof Decking Pavers
  7. Decorative Metal Railing
- C. Interior Assemblies and Finishes Mock-ups: Provide finish mock-ups of the following items and as specified in the individual Sections. Mock-ups shall show materials and workmanship to be expected in the completed work including vertical and horizontal transitions to other materials. Make necessary revisions as required until each mock-up is accepted by the University's Representative. Accepted mock-ups will be allowed to remain in place with written approval from the University's Representative. Provide mock-ups including but not limited to:
1. Interior Lobby Walls and Stairs
  2. Decorative Metal Railing
  3. Decorative Metal Stairs
  4. Wall Panel Systems
  5. Tile and Stone Flooring and Walls
  6. Ceiling Systems
  7. Typical rooms as specified including Flooring, Lighting, Window, Equipment, HVAC and Finishes
  8. Expansion Joints including Adjacent Materials and Finishes
  9. Intumescent Mastic Fireproofing

#### 1.03 MOCK-UP SUBMITTAL REQUIREMENTS

- A. Mock-ups shall not be fabricated until after acceptance of the mock-up submittals for all materials to be incorporated. This means that the Contract schedule shall take into account early submittal of these components to the University's Representative.
- B. Shop Drawings: Submit mock-up shop drawings with all materials and components, including structural elements and bracing. Clearly identify components and materials to be integrated into the assembly.
- C. Samples: Prior to construction of mock-ups, provide samples as specified in the respective Specification Sections included as part of the mock-ups.
- D. Structural Calculations: Submit structural calculations as required to ensure the structural integrity of the mock-up. The calculations shall be signed by a licensed California structural or civil engineer and shall be submitted to the University's Representative for review.

1.04 QUALITY ASSURANCE

- A. Design Concept: Mock-up requirements are intended to establish function, workmanship, waterproofing, finish, and color for conformance with the architectural design intent.
- B. Purpose: To verify suitability of colors, finishes and satisfactory integration of building materials and components indicated and required.
- C. Performance: Mock-ups shall be constructed for the University's Representative's review for compliance with the Contract Documents and shall be used as a standard for the final installation.
- D. Field test the mock-up wall window assemblies and adjacent exterior assemblies for air and water penetration following specified protocols in individual Sections.
- E. Make necessary corrections, additions and modifications to mock-ups as indicated by the University's Representative.
- F. Modify mock-ups, or construct or install new components if requested by the University's Representative, until final acceptance is obtained.
- G. Mock-ups shall serve as the standard for subsequent work of like kind after acceptance by the University's Representative. Provide as many modifications as required to achieve mock-ups that are acceptable to the University's Representative and of sufficient quality to serve as the standard for the complete Project.
- H. Following acceptance, mock-ups shall serve as a performance standard of quality and appearance of the work it represents, including the interface with adjacent materials and components as applicable.
- I. Coordinate fabrication, delivery, assembly, and installation with related materials to be included in the mock-ups. Construction of the mock-up assemblies shall be under the supervision of the same personnel who will be employed for the subsequent work.
- J. Maintain mock-ups in neat, clean condition. Repair damage as required to maintain in condition suitable for review and approval.
- K. Accepted building mock-up shall be removed from the Project site when indicated by the University's Representative.
  - 1. Remove and clear area after approval of the field mock-up only as indicated by the University's Representative.
- L. Accepted interior mock-ups may be incorporated into the work if the University's Representative agrees to that prior to the start of the mock-up and accepts the mock-up.
- M. Scheduling:
  - 1. Construct mock-ups in a timely manner to permit review and modifications such that the work is not delayed.
  - 2. Do not proceed with ordering of components or start construction subject to mock-up acceptance until after acceptances have been obtained.

3. Provide the University's Representative not less than ten (10) working days' notice of the time each component is ready for review.
4. Include line item in the construction schedule for the exterior building mock-up, showing submittals, construction, review, and approval periods.

## **PART II - PRODUCTS**

### 2.01 MATERIALS

- A. As specified in the respective Sections of the Specifications.

### 2.02 EXTERIOR BUILDING MOCK-UPS

- A. Provide a freestanding building mock-up section of building areas as indicated by the University's Representative.
- B. Purpose: Establish standards for Work indicated and specified to be included in mock-up to demonstrate quality of workmanship, materials, waterproofing, colors, and textures required by the Contract Documents. Include windows, sealants, siding, flashing, and other exterior materials.
- C. Mock-up will be used by the University's Representative to test color and material alternatives and to review and accept final colors, textures and workmanship. A maximum of 5 different colors may be tested as the mock-up for each component.
- D. Interior finishes will not be required to be installed on the interior side of the exterior building mock-up.
- E. Design Concept: Engineer and construct mock-up, including required shoring, bracing, foundations, power, etc., making required additions and modifications to details as required.
  1. Comply with performance requirements specified in the individual Specification Sections while maintaining basic design concept, member profiles, and alignment of components.
- F. Location: As agreed with the University Representative.

## **PART III - Not applicable to this section.**

**END OF SECTION 01 43 00**

**SECTION 01 45 00**  
**QUALITY CONTROL**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Contractor's Quality Control
- B. Quality of the Work
- C. Inspections and tests by governing authorities
- D. Inspections and tests by serving utilities
- E. Inspections and tests by manufacturer's representatives
- F. Inspections and Independent testing and Inspection Laboratories/Agencies
- G. Contractor's responsibilities in inspections and tests
- H. Contractor's responsibilities regarding the University's testing laboratory
- I. Test reports
- J. Geotechnical engineer

1.02 RELATED SECTIONS

- A. Section 013100 – COORDINATION
- B. Section 014100 – REGULATORY REQUIREMENTS: Compliance with applicable codes, ordinances and standards.
- C. Section 014550 – INSPECTION and TESTING of WORK
- D. Section 016100 – PRODUCT REQUIREMENTS: Product Options, substitutions, transportation and handling requirements, storage and protection requirements, and system completeness requirements.

1.03 CONTRACTOR'S QUALITY CONTROL

- A. Contractor's Quality Control: Contractor shall ensure that products, services, workmanship and site conditions comply with requirements of the Contract Documents by coordinating, supervising, testing and inspecting the Work and by utilizing only suitably qualified personnel.
- B. Quality Requirements: Work shall be accomplished in accordance with quality requirements of the Contract Documents, including, by reference, all Codes, laws, regulations and standards. When no quality basis is prescribed, the quality shall be in accordance with the best-accepted practices of the construction industry for the locale of the Project, for projects of this type.

- C. Quality Control Personnel: Contractor shall employ and assign knowledgeable and skilled personnel as required by contract or necessary if not prescribed to perform quality control functions to ensure the Work is provided as required.

#### 1.04 QUALITY OF THE WORK

- A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects and fit for the intended use.
- B. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements and adjacent construction.
- C. Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling and staining, until Acceptance by University.
- D. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report (ICC) requirements in preparing, fabricating, erecting, installing, applying, connecting and finishing Work.
- E. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviation is acceptable and appropriate for the Project.
- F. Verification of Quality: Work shall be subject to verification of quality by University's Representative and University's Consultant in accordance with provisions of the General Conditions of the Contract.
  - 1. Contractor shall cooperate by making Work available for inspection by University's Representative, University's Consultant or their designated representatives.
  - 2. Such verification may include mill, plant, shop, or field inspection as required.
  - 3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured, fabricated or stored.
  - 4. Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by University's Representative or University's Consultant.
  - 5. Contract modifications, if any, resulting from such verification activities shall be governed by applicable provisions in the General Conditions of the Contract.
- G. Observations by University's Consultants: Periodic and occasional observations of the Work in progress will be made by University's Consultant and their consultants as deemed necessary to review progress of Work and general conformance with design intent.

- H. Limitations on Inspections, Tests and Observations: Neither employment of independent testing and inspection agencies nor observations by University's Consultant and their consultants shall relieve Contractor of obligation to perform Work in full conformance to all requirements of Contract Documents.
- I. Acceptance and Rejection of Work: University's Representative reserves the right to reject all Work not in conformance to the requirements of the Contract Documents.
  - 1. If initial tests or inspections made by University's Testing Laboratory or Geotechnical Engineer reveal any portion of the Work fails to comply with Contract Documents, or if it is determined that any portion of Work requires additional testing or inspection, additional tests and inspections shall be made as directed by University's Representative.
  - 2. If such additional tests or inspections establish such portions of the Work comply with Contract Documents, all costs of such additional testing or inspection will be paid by University.
  - 3. If such additional tests or inspections establish such portions of the Work fail to comply with Contract Documents, all costs of such additional tests and inspection shall be deducted from the Contract sum.
- J. Correction of Non-conforming Work: Non-conforming Work shall be modified, replaced, repaired or redone by Contractor at no change in the Contract Sum or Contract time.
- K. Acceptance of Non-Conforming Work: Acceptance of non-conforming Work, without specific written acknowledgement and approval of University shall not relieve Contractor of the obligation to correct such Work.
- L. Contract Adjustment for Non-conforming Work: Should University or University's Consultants determine it is not feasible or in University's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between University and Contractor. If equitable reduction in Contract Sum cannot be agreed upon, a Directed Change Order will be issued and the amount in dispute resolved in accordance with applicable provisions of the General Conditions of the Contract.

#### 1.05 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

- A. Regulatory Requirements for Testing and Inspection: Comply with California Building Code (CBC) requirements and all other requirements of governing authorities having jurisdiction.
- B. Inspections and tests by governing Authorities: Contractor shall cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.
  - 1. Such authorities include University's Building Inspection (code compliance), University's Fire Marshal's office and similar agencies.

1.06 INSPECTIONS AND TESTS BY SERVING UTILITIES

- A. Inspections and Tests by Serving Utilities: Contractor shall cause all tests and inspections required by serving utilities to be made for Work under this Contract. Scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.

1.07 INSPECTIONS AND TEST BY MANUFACTURER'S REPRESENTATIVES

- A. Inspections and Tests by Manufacturer's Representatives: Contractor shall cause all tests and inspections specified to be conducted by materials or systems manufacturers, to be made. Additionally, all tests and inspections required by materials or systems manufacturers as condition of warranty or certification of Work shall be made, the cost of which shall be included in the Contract Sum. Manufacturer's Representatives shall provide a PDF electronic report indicating but not limited to work or materials that are missing, not installed correctly, damaged or need correction. Manufacturer's Representatives shall issue a final PDF electronic report once all work and materials are installed correctly, functioning and in compliance with the Manufacturer's Warranty.

1.08 INSPECTION BY INDEPENDENT TESTING AND INSPECTION LABORATORIES

- A. Definitions:
1. The term "University's Testing Laboratory" means a testing laboratory retained and paid for by University for the purpose of reviewing material and product reports, performing material and product testing and inspection, and other services as determined by University.
- B. University will select an independent testing and inspection laboratory or agency to conduct tests and inspections as called for in the Contract Documents and as required by governing authorities having jurisdiction.
1. Responsibility for payment for tests and inspection shall be as indicated in the schedule below. All time and costs for Contractor's services related to such tests and inspections shall be included in Contract Time and Contract Sum.
- C. Contractor shall notify University, and if directed by University's Representative testing and inspection laboratory, when Work is ready for specified tests and inspections.
- D. Contractor shall pay for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:
1. Contractor's failure to properly schedule or notify testing and inspection agency or authority having jurisdiction.
  2. Changes in sources, lots or suppliers of products after original tests or inspections.
  3. Changes in means, methods, techniques, sequences and procedures of construction that necessitate additional testing, inspection and related services.



- E. Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design. Test and inspections shall include, but not be limited to, the following:

List the applicable services required, for example:

| Material Inspections and Tests |                                  | Paid by:   |
|--------------------------------|----------------------------------|------------|
| Concrete Reinforcement         | Reinforcement Inspection         | University |
|                                | Reinforcement Strength           | University |
| Cast in Place                  | Slump Tests                      | University |
|                                | Compressive Strength Tests       | University |
| Structural Steel               | Welding Inspection               | University |
|                                | High Strength Bolting Inspection | University |

- F. Test and Inspection Reports: After each inspection and test, one (1) PDF electronic report shall be promptly submitted to University's Representative, Contractor and to agency having jurisdiction (if required by code).

1. Reports shall clearly identify the following:
  - a. Date issued
  - b. Project name and Project number
  - c. Identification of product and Specification Section in which Work is specified
  - d. Name of inspector
  - e. Date and time of sampling or inspection was conducted
  - f. Location in Project where sampling or inspection was conducted
  - g. Type of inspection or test
  - h. Date of tests
  - i. Results of tests
  - j. Comments concerning conformance with Contract Documents and other requirements
2. Test reports shall indicate specified or required values and shall include statement whether test results indicate satisfactory performance of products.
3. Samples taken but not tested shall be reported.
4. Test reports shall confirm that methods used for sampling and testing conform to specified test procedures.
5. When requested, testing and inspection agency shall provide interpretations of test results.

6. Verification reports shall be prepared and submitted, stating tests and inspections specified or otherwise required for Project, have been completed and material and workmanship comply with the Contract Documents. Verification reports shall be submitted at intervals not exceeding six (6) months, at Substantial Completion of the Project, and at all times when Work of Project is suspended.

#### 1.09 CONTRACTOR RESPONSIBILITIES IN INSPECTIONS AND TESTS

- A. Tests, inspections and acceptances of portions of the Work required by the Contract Documents or by Applicable Code Requirements shall be made at the appropriate times. Except as otherwise provided, Contractor shall notify University's Representative to make arrangements for such tests, inspections and acceptances. Contractor shall give University's Representative timely notice of all required inspections as outlined in Specification Section 014550 – INSPECTION and TESTING of WORK, Item 1.05, Scheduling Inspections – Notification Requirements.
- B. If such procedures for testing, inspection or acceptance reveal failure of any portion of the Work to comply with requirements of the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated procedures, including compensation for University's Consultant's services and expenses.
- C. If University and/or University's Consultants are to observe tests, inspections or make acceptances required by the Contract Documents, University and/or University's Consultant will do so promptly and, where practicable, at the normal place of testing.
- D. Cooperate with testing and inspection agency personnel, University, University's Consultant's and their consultants. Provide access to Work areas and off-site fabrication and assembly locations, including during weekends and after normal work hours.
- E. Provide incidental labor and facilities to provide safe access to Work to be tested and inspected, to obtain and handle samples at the Project site or at source of products to be tested, and to store and cure test samples.

#### 1.10 CONTRACTOR RESPONSIBILITIES REGARDING UNIVERSITY TESTING LABORATORY

- A. Secure and deliver to University's Testing Laboratory adequate quantities of representative samples of materials proposed for use as specified.
- B. Submit to University's Representative the preliminary design mixes proposed for concrete and other materials, which require review, by University's Consultants and/or University's Testing Laboratory.
- C. Submit copies of product test reports as specified.

#### 1.11 TEST REPORTS

- A. University's Testing Laboratory shall submit one (1) PDF electronic copy of all reports to the University's Representative, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

#### 1.12 University will distribute one (1) PDF electronic copy of the reports to University's Consultants and Contractor. GEOTECHNICAL ENGINEER (If applicable or NOT USED)

- A. University will retain and pay the expense of a Geotechnical Engineer to perform inspection, testing and observation functions specified by University. Geotechnical

Engineer will communicate only with University. University's Representative shall then give notice to Contractor, of any action required of Contractor.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 45 00**

**SECTION 014510**  
**SEISMIC CONTROL – HCAI**

**PART I - GENERAL**

1.01 DESCRIPTION

- A. Provide all required seismic restraints and calculations to ensure that the installation of all architectural, mechanical, and electrical equipment/components are in compliance with all applicable seismic codes, standards, and specific information listed herein.

1.02 QUALITY ASSURANCE

- A. ASTM standards
- B. 2019 California Building Code, Title 24 (CBC)

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this Section including shop drawing and other documentation to comply to the requirement of this Section.
- B. Submit special seismic certification (OSP) for mechanical and electrical equipment/components as noted on CBC 1705A.13.3.1. Contractor shall bear all costs associated with all tests, engineering calculations and documentation required to obtain Department of Health Care Access and Information (HCAI) approval in accordance with this section in a timely manner if the Contractor chooses to select equipment that does not already have special seismic certification as noted on the design documents.
- C. Submit HCAI Pre-approved Manufacturer's Certification (OPM) as noted on the design drawings with only one applicable OPM per application.

**PART II - PRODUCTS**

2.01 SEISMIC RESTRAINT REQUIREMENTS

A. SUMMARY

- 1. This section covers the seismic restraint requirements for suspended distribution systems, vibration and non-vibration isolated items, systems and/or related suspended equipment.
- 2. The designers of record (DOR) as referenced in this specification shall be the project architect, structural engineer, and the appropriate system engineer (e.g., electrical, etc.).

3. An HCAI OPM determined by the DOR shall be considered as the specified seismic design for this project. Other non-OPM designs may be submitted as an alternate if they meet or exceed all the requirements contained within these specifications, HCAI pre-approved service loads, installation applications, and engineering services.
4. Channel framing materials, fittings and related accessories shall be as indicated on the OPM and on the drawings. All channel members (trapezes and braces) shall be solid strut. Field drill bolt holes at 1/16" larger than bolt size as required for connections. Back-to-back struts shall be stitch groove welded or button welded.
5. To facilitate plan review and construction, all construction documents should include an equipment schedule identifying all applicable equipment, its classification (fixed, movable, mobile, other, countertop, interim or temporary) and reference to support and attachment per Pin 68-Table 1.

**B. SEISMIC RESTRAINT DESIGN**

1. The attachment supports and seismic restraints of suspended non-structural components and distribution systems listed below shall be designed to resist the total design seismic forces prescribed in the CBC.
  - a. All equipment/components including but not limited to: electrical, mechanical, plumbing, fire sprinkler and architectural.
  - b. Without referencing OPM or HCAI pre-approved seismic attachment and supports shown on the design document, seismic support and attachment shall be engineered and built by the applicable system contractor. Engineering shall be performed (signed & sealed) by a licensed California Structural Engineer and submitted to the DOR and HCAI for acceptance prior to installation. Cost to be borne by the contractor.
  - c. Design and installation shall consider seismic relative displacement in accordance with ASCE 7-16-13.3.2.
  - d. Pipes with hazardous contents including but not limited to medical gas, fuel oil, natural gas piping, etc., regardless of size and weight shall be seismically braced per the OPM or HCAI pre-approved design.
  - e. Support and attachment requirements for fixed, interim, mobile, movable, other, and temporary equipment shall be in accordance with HCAI PIN 68.
2. Seismic restraint transverse and/or longitudinal spacing shall be in accordance with CBC and OPM and limited to the following:
  - a. Seismic design forces equal to or less than the capacity of the building structure.
  - b. 40' feet transversely and/or 80' feet longitudinally where pipes, conduits, and their connections are constructed of ductile materials (copper, ductile iron, steel, or aluminum and brazed, welded, or screwed connections).

- c. 20' feet transversely and/or 40' feet longitudinally where pipes, conduits, and their connections are constructed of nonductile materials (e.g., cast iron, no-hub pipe, and plastic).
  - d. 20' feet transversely and/or 40' feet longitudinally for bus ducts and cable trays, baskets, channels.
3. Contractor shall not adopt, use, or otherwise implement the omission of any seismic restraints without prior review and acceptance by the designers of record. All submittals for omission of seismic restraints must include the following and must be performed (signed & sealed) by a licensed California Structural Engineer and approved by HCAI.
  - a. Project specific cover letter clearly indicating that said engineer has completely reviewed the project documents, and that the items/systems were designed individually and in coordination with all other trades and references the code section(s) where the omission of seismic restraints is allowed.
  - b. Lateral motion of the supported items/systems shall not directly or indirectly impact adjacent life safety, emergency services and/or hazardous items/systems or their supports.
4. Seismic hardware brackets shall provide a (Captive) 360-degree connection that completely encloses or encircles the rod, anchor, bolt, fastener, etc. Open hook and/or open slot seismic hardware brackets shall not be allowed.
5. Seismic restraint assembly connections shall not incorporate the use of break-off bolts or nuts and pneumatic fasteners unless referenced in the OPM document.
6. Ceiling system shall not be used as a seismic restraint, sway brace and/or safety restraint material.
7. Non-seismic and/or safety restraints sway bracing shall meet or exceed that required for the attachment of seismic restraints to the building structure.
8. Seismic restraints shall be installed to provide a minimum of (2) two transverse and (1) one set of (2) two longitudinal braces per run and per the OPM document.
9. The accumulated load of multiple items at any given support (with or without seismic restraints) shall not overload the building structure and the support assembly.
10. Pipes, conduits, and other items attached to trapeze hangers shall be located uniformly along each individual trapeze hanger so that the accumulated load is evenly distributed.
11. Trapeze systems installed in a multi-layer configuration shall have seismic restraints designed and installed for each individual trapeze layer.
12. Design of supports, seismic restraints and anchorage to the structure shall consider all conditions that involve thermal, structural separation, relative displacement, building expansion and contraction.

13. SMACNA details shall not be used without prior approval by Structural Engineer of Record (SEOR).
- C. ACCEPTABLE MANUFACTURERS
1. HCAI Pre-approved Certified Manufacturer (OPM)
- D. ANCHORS, INSERTS AND FASTENERS
1. All anchors, inserts, fasteners, or connections to the structure shall be submitted to the structural engineer of record for review and acceptance prior to installation.
  2. Do not use any anchor or insert in concrete or metal decking with concrete fill, which does not have one of the following:
    - a. ICC evaluation report
    - b. HCAI pre-approval
  3. Cast-in-place inserts that contain internal threads shall include the installation of a jam or lock nut to secure the connection of the vertical support rod to the cast-in-place insert.
  4. Cast-in-place inserts that allow for horizontal adjustment shall not be allowed unless an engineered solution is provided to assure positive captured positioning and secured attachment.
  5. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or internally threaded anchors in concrete or metal decking with concrete fill without prior scanning of the slab and wall for clearances, and to prevent damages to embedded electrical conduits and/or mechanical piping and reinforcing steel.
  6. All beam clamps shall be constructed of malleable iron or steel. All single flange mounted beam clamps shall include a retaining strap or J-hook and must be submitted to the project structural engineer of record for review and acceptance prior to installation. Beam clamps shall not be used to resist seismic loads.
- E. FIELD QUALITY CONTROL
1. Inspection of seismic restraints by the Inspector of Record (IOR), and/or Authority Having Jurisdiction (AHJ).
  2. Special inspection for special seismic certification per CBC 1705A.12.4.

### **PART III - EXECUTION**

#### **3.01 SEISMIC ANCHORING AND RESTRAINTS**

- A. Equipment anchors:
1. All equipment shall be anchored. Anchor equipment per details shown on the drawings where provided.
  2. Anchor installation shall be in accordance with the current ICC report.

3. Anchor details provided are based on specific equipment information. Submit design for approval for anchoring of equipment which varies from design.
- B. Conduit supports:
1. Conduits shall be supported and braced per CBC.
- C. Lighting fixture supports:
1. Provide independent seismic support system per CBC.
- D. Minimum clearance:
1. Diagonal braces and hanger supports shall maintain 6 inches minimum clearance from unbraced ducts and conduits, and 1-inch minimum clearance from braced ducts and conduits.
  2. Except for sprinklers installed using flexible sprinkler hose, installed clearance shall be 3 inches between any sprinkler drop or sprig and permanently attached equipment and other distribution systems, including their structural supports and bracing.

### 3.02 INSTALLATION AND TESTING OF MECHANICAL ANCHORS:

- A. Where permitted in other Sections of this specification, drilled-in expansion-type anchors or other post-installed concrete anchors may be used in hardened concrete.
- B. All post-installed concrete anchors shall be tested. Testing shall be performed in the presence of the Inspector of Record. Number of anchors to be tested shall be as shown on the drawings with a minimum of 50% of anchors installed and at each support. Testing shall be performed by torque or pull test, and to the values noted on the drawings. Test loads, frequency, and acceptance criteria of post-installed anchors in concrete shall be in accordance with CBC 1910A.5.
- C. Internally threaded shell-type anchors and displacement-controlled anchors (e.g., drop-in anchors, screw anchors, adhesive anchors, etc.) shall not be tested using a torque wrench.
- D. Screw anchors shall be installed with a calibrated torque wrench and may be loosened a maximum of one full turn to facilitate the positioning of a tension test collar. Following the tension test, the anchor shall be re-torqued in accordance with the manufacturer's installation instructions.
- E. Tension test of chemical/adhesive anchors and power actuated fasteners shall be in accordance with CBC and as noted on the drawings.
- F. All testing procedures shall be in accordance with CBC 1910A.5, and as noted on the drawings.
- G. Locate existing reinforcing steel and conduits in slabs and walls prior to drilling holes for the mechanical anchors.

**END OF SECTION 014510**



## SECTION 01 45 50

### INSPECTION AND TESTING OF WORK

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Project Inspections and Procedures
- B. Scheduling Inspectors – Notification requirements

##### 1.02 RELATED SECTIONS

- A. Section 013100 – COORDINATION
- B. Section 013200 – CONTRACT SCHEDULES
- C. Section 013500 – SPECIAL PROCEDURES
- D. Section 014100 – REGULATORY REQUIREMENTS
- E. Section 014500 – QUALITY CONTROL

##### 1.03 DEFINITIONS

- A. IOR: Inspector-of-Record
- B. ACO: Area Compliance Officer for HCAI
- C. DSE: District Structural Engineer for HCAI
- D. FM: Fire Marshal (may include both HCAI FM and State FM)
- E. TL: Testing Laboratory

##### 1.04 PROJECT INSPECTIONS AND TESTING PROCEDURES

- A. Inspections: This Project (is) (is not) under the jurisdiction of the Department of Health Care Access and Information. The following inspections will be requested on this project, as appropriate. Also see Part 3 for non-HCAI inspection items or Part 3, Item 3.11 for HCAI requirements.
  - 1. Inspections required by the California Building Code
  - 2. Inspections listed on the Testing, Inspection and Observation (TIO) form
  - 3. Final inspections

Procedures: University's Representative shall be the Contractor's contact for all inspection requests. Contractor shall fill out Inspection Request Form for all inspections.

1. Contractor shall properly plan and coordinate inspection requests. Schedule delays caused by Contractor's failure to plan and/or coordinate inspection requests will not be considered for adjustments to Contract Time or Contract Sum.
2. A complete set of HCAI/SFM stamped and approved Contract Drawings and Contract Specifications, including applicable shop drawings and building permit shall be available on site for review by the Inspector-of-Record. The Contractor, Subcontractors and other responsible parties shall be present during inspection walk-throughs. All areas of project scope shall be ready and accessible for inspection. Contractor shall provide access equipment as applicable for the inspector's needs.
3. A complete set of codes referred to in the approved plans must be maintained on the job at all times.
4. Contractor shall submit verified compliance reports as outlined in the California Administrative Code, Section 7-151.

#### 1.05 SCHEDULING INSPECTIONS –NOTIFICATION REQUIREMENTS

- A. Advance Inspection Notification: University's Representative for this project requires the following advance notifications to schedule appropriate inspection agencies at the project site.
  1. IOR Inspection Request Notification: Twenty-four (24) hours. Note: Inspection requests received by 2:00 PM will be scheduled for next day inspection. Inspection requests received after 2:00 PM will be scheduled for the following day; (example: Inspection request received at 2:01 PM on a Monday would be scheduled for inspection on Wednesday). Weekend and off-hours inspection requests will be scheduled on a case-by-case basis with a minimum of seventy-two (72) hour inspection request notification.
  2. HCAI Field Compliance Inspectors: Fourteen (14) calendar days.
  3. Testing Laboratory Inspections: Forty-eight (48) hours.
    - a. All testing laboratory and testing procedures must be scheduled by University's Representative. Inspections and/or testing directly scheduled by Contractor will not be accepted.
    - b. Contractor will bear all costs associated with unauthorized inspections and testing.
  4. State Fire Marshal Inspection Request Notification: Seventy-two (72) hours.

B. Methods of Inspection Notification:

1. All inspection notifications shall be in writing using inspection forms located at back of this Section. Incomplete forms will be returned as non-compliant, and no inspection will be scheduled until all required inspection information is provided.
2. Emailed inspection requests will be accepted. University's Representative email address is lfuka@ucdavis.edu Notification time begins from the date and stamp of the email, provided it is sent during normal business hours. Emailed inspection requests sent after normal business hours and/or received on non-normal workdays, as defined in Specification Section 013100 – COORDINATION, paragraph 1.07.F.4.A will begin notification time starting at 7:00 AM the following normal business day.

C. Off-hours Inspection Requests: Contractor shall provide time windows for all off-hour or other than normal work hour inspections. University's Representative shall have final authority in setting times of off-hour inspections.

D. Re-inspections:

1. More than two (2) re-inspections: The cost of re-inspections of the same work, more than twice, shall be deducted from Contract Sum. IOR's hourly rates are \$153.00 per hour during normal work hours and \$229.50 per hour for all off-hour inspections. University will provide itemized invoice for Contractor's records.
2. Work unprepared for inspection: Re-inspections of the same work scheduled by Contractor, but not ready for inspection will be identified as a re-inspection.

**PART II - PRODUCTS – Not Applicable to this Section.**

**PART III - EXECUTION**

Note: Part 3 describes typical inspection requirements for each individual inspector's jurisdiction for non-HCAI projects. Part 3 is provided as a reference source for Contractor's use and Scheduling, as applicable. Part 3 is not intended to be all-inclusive and Contractor shall verify actual inspection requirements needed for this project. See Item 3.11 for Testing, Inspection Observation for HCAI.

3.01 FIRE DAMPERS (Title 24, Part 2, Chapter 43)

Note: Manufacturer's installation instructions shall be used for inspections and testing.

- A. 1 Hour: IOR test 100%. State Fire Marshal tests 100% or as needed.
- B. 2 Hour: IOR tests 100%. State Fire Marshal tests 100%.
- C. Smoke: IOR tests 100%. State Fire Marshal tests 100%.

3.02 FIRE SPRINKLERS (Title 24, Part 2, Volume 1, Chapter 9; NFPA Bulletin 13)

- A. Approved drawings shall be on jobsite from start to completion of project.
- B. Underground pressure test @ 200 psi.
- C. State Fire Marshal to witness installation of underground lines.
- D. State Fire Marshal to witness underground flush prior to connection.
- E. Hydro-test above ground piping @ 200 psi for two (2) hours.
- F. Inspection of hangers, bracing, and seismic joint crossing(s).
- G. Flow alarm test, tamper switch test.
- H. Fire pump test.
- I. Certification by installer (Title 24, Part 9, Article 1006.3.4.2).
- J. Final inspection: signs in place, labeling, fire extinguishing system flow alarm test.

3.03 FIRE ALARM SYSTEM (Title 24; Part 9, Article 1006)

Note: Fire Sprinkler and Fire Alarm systems tests shall be performed in presence of State Fire Marshal.

- A. Approved drawings shall be on jobsite from start to completion of project.
- B. Verify Emergency Power source.
- C. Activate all initiating devices.
- D. Certification by installer (Title 24, Part 9, Article 1006.3.4.2).
- E. Complete test of system per Title 24, Part 9, CFC, Article 1003.3.4.1).

3.04 MEANS OF EGRESS (Title 24, Part 2, Volume 1, Chapters 10)

- A. Exit sign/light locations and connected to two (2) sources of power.
- B. Normal Power.
- C. Emergency Electrical System, Life Safety Branch.
- D. Construction - floors, walls, ceilings, penetrations per listings.
- E. Electrical boxes - no back to back, 24 inches horizontal separation (Section 709).
- F. Electrical boxes - 100+ square inches to be wrapped/protected.
- G. Flame Spread, Fuel Contribution and Smoke Density for finishes (Chapter 8).

3.05 EMERGENCY LIGHTING

- A. Generator Test (Title 24, Part 3, Section 700-4; Section 701-5).
- B. Emergency lights - locations (Title 24, Part 2, Volume 1, Chapter 10, Section 1003.2.8.5).

3.06 KITCHEN HOOD FIRE SUPPRESSION SYSTEM (Title 24, Part 9, Article 10, Section 1005; Part 9, Section 10.513)

- A. Approved drawings shall be on jobsite from start to completion of project.
- B. State Fire Marshal to witness system test.

3.07 MECHANICAL CHECKLIST FOR CLOSE-OUT (Title 24, Part 4)

A. Mechanical Equipment Requirements

1. Access to Equipment (Section 305, 405, 606.5, 815, 2.2.8, 903, 910.8, 1106.3).
2. Labeling of Equipment (Section 307).
3. Identification of Equipment - Area or Space Served (Section 304.5).

B. Mechanical Testing

1. Air balance completed and reviewed by Mechanical Engineer-of-Record.
2. Hospitals (Chapter 3, Section 314.1, Table 2110-A).
3. Skilled Nursing (Chapter 3, Section 314.2) **[test to include humidity controls in required areas - Section 2102(a)]**.
4. Hydronic balance completed and reviewed by Mechanical Engineer-of-Record.
5. Air and Hydronic reports forwarded to Mechanical Engineer of Record.
6. Fuel Gas line inspection (Part 4, Section 1406 and Appendix B, Chapter 16).
7. Atrium and/or Building Smoke Evacuation System (State Fire Marshal to witness).

C. Boilers

1. Boiler – Operating Adjustments and Instructions (Section 1022).
2. Boiler – Inspections and Tests (Section 1023).
3. Boiler – Clearances/Permits (Section 1005.0).

D. Ducts

1. Installation - Bracing (Part 4, Section 604.1.4)
2. Fire Damper test log from IOR (Part 4, Section 606.2).
3. Fire Damper test by State Fire Marshal (Part 4, Chapter 6, Section 606.2).
4. Smoke Damper and Detector test log from IOR (Including Duct Detector tests).
5. Smoke Damper and Detector by State Fire Marshal.

E. HVAC Unit Testing

1. Verify correct filter types and efficiencies.
2. Motor Rotation.
3. Condensate drain tests (Section 310).
4. Equipment shut down by smoke detectors (duct or space).

3.08 PLUMBING CHECKLIST FOR CLOSE-OUT (Title 24; Part 2, Chapter 29; Part 5)

A. Piping Systems (Title 24, Part 5)

1. Domestic Water Line Sterilization Test (Title 24, Part 2, Section 609.9; Title 22, Division 4, Chapter 16, Article 5).
2. Domestic Water System (hot, cold) Pressure test (Title 24, Part 5, 609.4).
3. Natural Gas Pressure Test (Title 24, part 5, Chapter 12, Section 1204).
4. Vent & Waste System Pressure test (Title 24, Part 5, 712.0).
5. Hydronic Water Pressure test (Title 24, Part 4 1201.2.8).

B. Water Heater Testing

1. Water Heater Temperature Test (Domestic/Patient) (105-120°F).
2. Water Heater Temperature Test (Kitchen) (180°F).
3. Water Heater Temperature Test (Laundry) (169°F).
4. Water Heater Temperature Alarm Test (Patient) (125°F).

C. Medical Gas System Testing (NFPA 99, Chapter 4) (Witnessed by SFM).

1. Pressure test - 150 psig - Oxygen, Medical Air & Nitrous Oxide (4-3.4.1.2).
2. Pressure test - 200 psig - Nitrogen (4-5.1.3.4).
3. 24-hour pressure test - 60 psig - Vacuum system (4-10).
4. 24-hour pressure test - 20% over operating pressure **[A-4.3.4.1.2 (b)(e)]**.
5. Alarm test for system **[4-3.4.1.3 (d)]**.
6. Area Valves, location, labeled, alarms tested (4-4.1 & 4-5.1.4).
7. Laboratory testing affidavits - welding/brazing (4-6.2.3.3).
8. Verified Medical Air Quality - Installation and 24 hour later.
9. Certification of system (Purity, Cross Connection, Alarms, Etc.) **[4.5]**.
10. Certification of Bulk System **[NFPA 50 (Oxygen) & CGA G-8.1 (Nitrous Oxide)]**.
11. Approved drawings and documents for submittal to University's Representative for

permanent records).

3.09 ELECTRICAL CHECKLIST FOR CLOSE-OUT (Title 24, Part 3, and Part 1, Chapter 7, Section 7-141, 7-149)

A. Main Panel/Service

1. Identification and Labeling of Equipment (110-21, 110-22, 230-70).
2. Grounding test and Certification (250, 250-56).
3. Ground fault interrupt test adjustment and certification **[230-95(c); 517-17(c)]**.
4. Emergency power transfer switch test (700-4).
5. Panel load balance.

B. Emergency Power and Standby Systems (Article 700 & 701) **[Test Logs from IOR]**

1. Emergency Generator testing and certification (701-5).
2. Identification and Labeling of equipment (110-21, 110-22, 517-22).
3. Lighting and Lighting Levels (517-22).
4. Receptacles (410L, 517-13, 517-18, 517-19).
5. Exiting signs and lights **[517-32(b), 517-42(b)]**.
6. Nurse and Staff Call **[517-33(a)]**.
7. Fire Alarm (760).

C. General Electrical Requirements

1. Working space/Headroom **[Table 110-26(a); 110-33; 110-34]**.
2. Circuits and lights tested (410-45).
3. Receptacle polarity and grounding **[200-10(b)]**.
4. Isolated ground monitor test **[517-160(b)]**.
5. Motor load current adjustment.
6. Identification and Labeling of equipment (110-21; 110-22).
7. Identify circuits (Critical Care Areas) (517-19).

D. Miscellaneous Electrical Requirements

1. Test logs from Contractor and Inspector-of-Record.
2. Electrical Engineer-of-Record acceptance of system.
3. Owner In-Service training on Equipment.
4. Equipment Manuals and Instruction to Owner.

5. Warrantees and Equipment Certification.
6. As-Built documents to Owner.

### 3.10 FIRE MARSHAL INSPECTION REQUIREMENTS

#### A. Framing Inspections

1. Structural members in fire-resistive construction.
2. Check fireproofing per approved design tested assembly description.

#### B. Fire-Rated Partition Locations

1. Check for stud and nailing/screwing spacing per approved design tested assembly description.
2. Check for fire blocking in combustible construction.
3. Check for rated door/window frame installation (manufacturer's installation instructions shall be available for review).
4. Check for electrical installation, for example, number and size of electrical boxes, panels, cabinets, etc.
5. Check hangers, seismic bracing for sprinkler piping installation, if applicable (this would be checked during overload pressure test inspection phase of sprinkler system).

#### C. Close-In Inspections

1. Check fire-blocking and draft stops in combustible construction.
2. Check gypsum board installation in accordance with approved design assembly description for rated assembly.
3. Check integrity of firewall construction where recessed cabinets, panels, excessive electrical/plumbing are installed.



4. Check fire damper installation (manufacturer's installation instructions shall be available for review). Fire Marshal will witness actuation of minimum 10% fire dampers installed and 100% in 2 hour or greater fire rated wall assemblies.
5. Check for through-penetrations and fire-stop systems in all walls or floor/ceiling assemblies.
  - a. Check top of wall to structure fire stopping.
6. Check above ceiling areas and construction prior to installation of ceilings.
  - b. Check access and serviceability for above ceiling to included but not limited to valves, mechanical equipment, electrical equipment and other components that require adjustment, access or service.
  - c. Contractor shall move any items including but not limited to conduit, piping, braces and other obstructions that block access to equipment and components needing adjustment, access or service.
  - d. Check bracing, anchorage, fasteners and installation.

D. Final Construction Inspections

1. Final project walk-through: Example, Emergency lighting will be tested to verify exit illumination of both interior and exterior, while generator (if applicable) is tested at same time.

3.11 HCAI – Testing, Inspection and Observation (TIO)(If applicable or NOT USED)

**Note: This item describes the required code related inspection items for HCAI projects. It will be completed by design professional prior to construction. This checklist is not intended to be all-inclusive, and contractor should verify actual inspection requirements. (Attach completed and approved HCAI TIO form signed by Architect/Engineer of Record for required testing.)**

3.12 Refer to the following attachment

- A. Inspection Request
- B. Non-conforming Work Notice

**END OF SECTION 01 45 50**

# INSPECTION REQUEST

Project #: \_\_\_\_\_ HCAI #: \_\_\_\_\_ UCDH IR #: \_\_\_\_\_ [Contractor][CM/Contractor][Design-Builder] IR #: \_\_\_\_\_ Date: \_\_\_\_\_  
Project Name: \_\_\_\_\_ Spec Section (s): \_\_\_\_\_

|   |  |
|---|--|
| To: UC Davis Health<br>Facilities Design & Construction – Inspection Trailer<br>4430 V Street, Building 35<br>Sacramento, CA 95817<br>P: 916-734-5060<br>Email: lfuka@ucdavis.edu & Project IOR | From: _____<br>_____<br>_____<br>P: _____<br>E-mail: _____ |
|---|--|

Drawing Ref.: \_\_\_\_\_ Detail: \_\_\_\_\_ Shop Drawing: \_\_\_\_\_

Project Schedule Activity ID No.: \_\_\_\_\_ Date of Inspection: \_\_\_\_\_ Time Requested: \_\_\_\_\_

Type of Inspection: \_\_\_\_\_

Location of Inspection (i.e., Floor, Column Line, etc.): \_\_\_\_\_  
\_\_\_\_\_

\*Re-inspection Requested for Previous UCDH IR #: \_\_\_\_\_

All work Requested for Inspection has been reviewed for compliance with the contract documents by [Contractor][CM/Contractor][Design-Builder]'s Superintendent prior to notification of Inspection Request.

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

### UNIVERSITY USE ONLY

Date Received: \_\_\_\_\_ Time of Inspection: \_\_\_\_\_

Date of Inspection: \_\_\_\_\_ Inspector: \_\_\_\_\_  Inspection Report Attached

Inspector Arrival Time: \_\_\_\_\_ Inspector Departure Time: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Approved       Approved as Noted       Not Approved       Cancelled

Inspection Request Notes or Description of Items of Deficiency if needed below (Part 1, Chapter 7, Section 7-145, item 6)

|  |
|--|
|  |
|  |
|  |
|  |

Project Field Record of Construction Progress Summary of Work in Progress (Part 1, Chapter 7, Section 7-145, item 6)

*Project Phase (Building Foundation, Structural, Wall Framing, Electrical Rough-In, Sprinkler Rough-In, etc.)*

|  |
|--|
|  |
|  |
|  |

Project Phase Percentage Complete (% of the phase completed): \_\_\_\_\_

Overall Project Percentage Complete: \_\_\_\_\_

**NON-CONFORMING WORK NOTICE**

PROJECT #: \_\_\_\_\_ HCAI #: \_\_\_\_\_ Notice #: \_\_\_\_\_ Date: \_\_\_\_\_

|  |   |
|--|---|
| To: [PROJECT MANAGER NAME/EMAIL] _____<br>[DESIGN PROFESSIONAL NAME/EMAIL] _____<br>[IF HCAI PROJECT, AREA COMPLIANCE OFFICER/EMAIL] _____<br>_____<br>_____ | From: UC Davis Health IOR<br>Facilities Design & Construction – Inspection Trailer<br>4430 V Street, Building 35-A<br>Sacramento, CA 95817<br>P: 916-734-5060 |
|--|---|

Spec Section Ref.: \_\_\_\_\_ Paragraph: \_\_\_\_\_ Drawing Ref.: \_\_\_\_\_

Detail: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

In accordance with Article 12 of the General Conditions, the following defective condition(s)has/have become apparent:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reported by: \_\_\_\_\_

**CORRECTIVE ACTION SHOULD BE TAKEN AS SOON AS POSSIBLE AND COMMENCE NO LATER THAN TEN (10) CALENDAR DAYS AFTER THIS NOTICE. COORDINATE THE VERIFICATION OF THE CORRECTIVE ACTIONS WITH THE INSPECTOR OF RECORD. IF FURTHER INFORMATION IS NEEDED, ADVISE UNIVERSITY'S REPRESENTATIVE IN ACCORDANCE WITH THE GENERAL CONDITIONS.**

Description of corrective action taken: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

CC:

**SECTION 01 51 00**  
**TEMPORARY UTILITIES**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Temporary Power and Lighting.
- B. Temporary Heating, Cooling & Ventilation.
- C. Temporary Water.
- D. Temporary Fire Protection.
- E. Temporary Telephone, Data, and WIFI.

1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK
- B. Section 013500 – SPECIAL PROCEDURES: General requirements for temporary facilities and controls, to accommodate the University's occupancy and use of the areas and spaces adjacent to construction.
- C. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- D. Section 017400 – CLEANING
- E. Section 017700 – CLOSEOUT PROCEDURES

1.03 TEMPORARY UTILITIES

- A. Temporary Connections: Temporary power, water, sewer, gas and other utility services necessary for the Work may be made to existing building systems. Connections shall be subject to University's review and written approval. Coordinate with utility companies and University's Plant Operations & Maintenance Department for locations and methods of connections.
- B. Contractor shall provide and pay for installation, operation, maintenance, and removal of all utilities. The services will be provided at the current rates for each utility.

1.04 TEMPORARY POWER AND LIGHTING

A. Service Requirements:

1. Temporary Electrical Service: Contractor shall provide and pay for installation, operation, maintenance, and removal of temporary electrical service, lighting devices and restoration of existing and permanent equipment in accordance with applicable provisions of the Electrical Safety Orders of the State of California. Use of University's electrical power and lighting system is prohibited without University's written approval and will be considered only when an alternate electrical power source is unavailable.
  - a. Install initial services at time of site mobilization.
  - b. Modify and extend systems as Work requires.
  - c. Maintain electrical system to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.
  - d. Restore existing and permanent lighting used during construction to original condition. Replace defective fixtures, bulbs, and other component parts.
  - e. Clean existing and permanent lighting fixtures used during construction per Section 017400 – CLEANING.
2. Distribution: Contractor shall provide distribution network for temporary electrical power.
3. Power Source: Arrange for service with University's Plant Operations and Maintenance Department, or local utility company.
4. Conformance: All temporary wiring and electrical facilities shall be in accordance with applicable provisions of Electrical Safety Orders of the State of California.
5. Temporary Lighting: Construction lighting shall be supplied and maintained by Contractor at Contractor's expense. Sufficient lighting levels shall be provided to allow construction to be properly and safely performed. Contractor shall give special attention to adequate lighting for stairs, ladders, floor openings, basements and similar spaces. Promptly replace burnt out, worn or defective parts.
6. Lighting fixtures: Locate fixtures in areas of Work: One (1) lamped fixture in rooms, except closets and utility chases; one (1) lamped fixture for every 750 square feet in large areas.
7. Security Lighting: Contractor shall provide security lighting during hours of low visibility.

- B. Distribution requirements:
1. Weatherproof distribution boxes with one (1) - 240-volt, three (3) phase power outlet and four (4) – 120-volt outlets consisting of 100 amperes fused switches with equipment ground, spaced so a 100-foot extension cord will reach all areas of building.
  2. Wiring, connections and protection for temporary lighting.
  3. Wiring connections and protection for temporary and permanent equipment, for environmental control, for temporary use of electricity operated equipment, and for testing.
- C. Use of University System: If alternate electrical power and lighting sources are unavailable, University may permit Contractor to use existing, in-place electrical system. University does not guarantee availability of electrical power or adequate lighting levels through use of existing system. If power and lighting is insufficient or not available Contractor shall provide secondary source (i.e., generator) as approved by University.
1. It is expressly understood and agreed by Contractor that University existing power and lighting system's primary obligation is servicing patient care. The University system is not designed for purposes of construction activities.
  2. Contractor should expect power and lighting interruptions during course of Work. Contractor will be required to cease use of University electrical-power and lighting systems, as required by the needs of University.
  3. When use of University electrical system is approved in writing, Contractor is required to adhere to University's electrical lockout procedures. See Division 26– Electrical or Campus Design Guidelines.
    - a. Provide and maintain warning labels on energized equipment.
    - b. Replace plates, electrical devices or similar existing items or components damaged as a result of temporary usage.

#### 1.05 TEMPORARY HEATING, COOLING AND VENTILATING

- A. Service Requirements:
1. Contractor shall provide temporary heat as necessary for proper installation of all work and to protect all work and materials against injury from dampness and cold and to dry out building. Fuel, equipment and method shall be approved in writing by University's Representative.
  2. Install initial services at time of site mobilization. Modify and extend systems as Work requires.
  3. Maintain systems to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.
  4. Use of permanent heating system is preferred to any other system for maintaining temperature of building during installation of finish materials, but such use will not be permitted before clean-up after plastering and/or drywall work has been completed. Contractor shall make every effort to complete permanent heating

system in time for such use. Permanent fans shall not be used before filters are installed. Filters shall be cleaned and serviced by Contractor just prior to final acceptance.

- a. Vent portable units to building exterior, complete with automatic controls. Direct-fired units are not allowed. Locate units and outlets to provide uniform distribution of heating, cooling and ventilating.
  - b. Operate and maintain existing equipment being used; clean or replace filters and install filters in duct extensions as necessary to maintain occupied areas, work areas and finished areas, in specified condition.
  - c. Prior to operation of permanent equipment, verify controls and safety devices are complete, equipment has been tested, and inspection made and approved for operation.
  - d. Remove temporary materials and equipment when permanent system is operational. Restore existing and permanent systems used for temporary purposes to original condition.
  - e. Install temporary filters in air handling units and ducts, replace as necessary to prevent dust in equipment and ducts, to avoid contaminants in Work or finished areas. After completion, replace temporary filters with new, clean, reusable filters.
5. Maintain temperature, humidity, and ventilation in enclosed areas to provide ambient conditions for storage, preparation and Work; to cure installed materials, to prevent condensation, to dry floor surfaces and to prevent accumulations of dust, fumes and gases.
  6. During non-working hours maintain temperature in enclosed areas occupied solely by Contractor at a minimum of 50°F., or higher as specified in individual Sections and by individual product suppliers and manufacturers. Areas occupied in whole or in part by University are to be maintained at normal temperatures.
  7. Provide high efficiency particulate air (HEPA) filters as specified in SECTION 015610 – AIRBORNE CONTAMINANTS CONTROL, negative pressure ventilation, or special control of existing system as determined by University's Representative.

B. Utility Sources:

1. Electrical: As specified above in Item 1.04.
2. Existing mechanical systems may be used for temporary purposes. Coordinate use with University for conditions to be maintained in adjacent University occupied areas.
3. Contractor shall provide and pay for all installation, operation, maintenance and removal of equipment in accordance with applicable provisions of the Electrical Safety Orders of the State of California.

1.06 TEMPORARY WATER

A. Service Requirements:

1. Maintain systems to provide continuous service, including prompt restoration of interruptions to University's systems when temporary service is connected.
2. Water service, if necessary for construction, can be made available at no expense to the Contractor provided the water is not wasted. Contractor shall be responsible for distribution of water to points of use.
3. Certified reduced pressure type back-flow prevention device as submitted to and approved by University shall be installed before water is obtained from a University campus fire hydrant or interior building connection.

B. Plumbing: Maintain system to provide continuous service with adequate pressure to outlets, including University system when temporary service is connected. See also Division 1 Approvals and ILSM requirements.

1. Size piping to supply construction needs, temporary fire protection, and for University's needs when existing service is connected.
2. Disinfect piping used for drinking water. See Division 33 and 22 for requirements or Campus Design Guidelines
3. Source: University existing service, connect at locations as directed by University.
4. Provide valved outlets to control water pressure adequately for hoses.
5. Fire hydrants used for water supply for construction –Contractor must use only  $\frac{7}{8}$ " square hydrant wrench on square operating nut and must use only pentagon wrench on pentagon operating nut. This is to prevent damage to the hydrant operating nut. Any damage caused by the use of an improper wrench or other misuse of the hydrant must be repaired at contractor expense. Contractor must inspect hydrant prior to use and make the University aware of any pre-existing damage.



- C. Use of Existing System: Existing system may be used for temporary water. Monitor usage to prevent interference with University's normal operational requirements.
- D. Use of Permanent System: Contractor shall obtain written agreement from University establishing start of warranty period and conditions of use.
- E. Contractor shall pay for installation, operation maintenance and removal of system and restoration of existing and permanent equipment. University will pay costs of water consumed for normal construction operations. Contractor shall take measures to conserve usage.

#### 1.07 TEMPORARY FIRE PROTECTION

- A. Requirements:
  - 1. Maintain systems to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.
  - 2. Provide and maintain fire protection equipment including extinguishers, fire hoses and other equipment as necessary for proper fire protection during course of the Work.
  - 3. Use fire protection equipment only for fighting fires.
  - 4. Locate fire extinguishers in field offices, storage sheds, tool houses, other temporary buildings and throughout construction site. In area under construction, provide at least one (1) fire extinguisher for each 5,000 square feet of building floor area. Locate fire extinguishers so that a person never has to walk more that seventy-five (75) feet to obtain one.
  - 5. Assign qualified person with authority to maintain fire protection equipment, institute fire prevention measures, and direct prompt removal of combustible and waste material. Submit ILSM requirements per Specification SECTION 013500 – SPECIAL PROCEDURES.

#### 1.08 TEMPORARY TELEPHONE, DATA, INTERNET, and WIFI

- A. Service Requirements:
  - 1. Maintain systems to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.
  - 2. Contractor shall select from the following options:
    - a. University shall provide conduit, cabling and dial tone to Contractor's location(s). Contractor shall pay University for cable, conduit installation and later removal of same and also pay University a monthly fee for use of University telephone, data internet, and WIFI system.

- b. University shall provide conduit and cabling to Contractor's location(s). Contractor shall receive dial tone from local utility. Contractor shall pay University for cabling, conduit installation, maintenance of same and later removal of same. Contractor shall pay local utility for monthly telephone, data, internet and WIFI service.
    3. Contractor shall select number of lines, instruments and other features.
    4. Contractor shall prepare and submit to University an itemized request for telephone lines (according to option 2a or 2b above) and internet service. Project Manager will submit a service request to the IT department.
- B. Use of Existing System: Existing University telephone system shall not be used for temporary telephone service.
- C. Contractor Phone:
  1. Contractor shall have telephone emergency number or other facility available at Contractor's business office for duration of contract where contractor and superintendent may be contacted within twenty-four (24) hours. Provide emergency numbers to University.
- D. Telephones:
  1. Contractor shall use, and only permit to be used, FCC approved communication devices on frequencies approved by FCC and University.
  2. Contractor shall not use, or permit to be used, communication devices which interfere with existing University communication systems, including, but not limited to:
    - a. Life Flight or CHP helicopters.
    - b. Emergency Service vehicle communications.
    - c. Plant Operations & Maintenance communication devices.
    - d. Microwave transmission stations.
    - e. UC Davis Health closed-circuit television or radio signals.
    - f. Cellular or other mobile phone systems in main hospital.
    - g. UC Davis Health voice or digital paging systems.

- E. Temporary Internet Service: Provide a high-speed internet connection (Min. 20 Mbps download, 10 Mbps upload) to Contractor's field offices. The Contractor's and University's field offices shall be capable of sending and receiving e-mail and be able access the Internet.
  - 1. **[WIFI coverage at the above internet speeds will be provided throughout the jobsite]**

## **PART II - PRODUCTS**

### 2.01 MATERIALS

- A. May be new or used, adequate to the purpose.
- B. Devices and Equipment: Standard devices, meeting UL requirements.
- C. Telephones: may be product of local service company or specialty devices compatible with service company requirements.
- D. Modems compatible with internet service.

## **PART III - EXECUTION**

### 3.01 INTERRUPTION OF EXISTING SERVICES

- A. No existing utility services shall be interrupted at any time without prior written approval from the University. Required shutdowns shall be scheduled a minimum of fourteen calendar days prior to actual shutdown. The operation of valves, switches, etc. will be performed and paid for by University.
  - 1. Prior to the outage, all possible Work shall have been completed which will minimize the length of the required outage. During the outage, the Work will be prosecuted with diligence by an adequate number of skilled personnel.
  - 2. Provide and pay for all personnel required by the University to maintain safe conditions during the outage including but not limited to fire watch, safety monitors and/or traffic control. Coordinate Work with University's Representative.

### 3.02 REMOVAL OF TEMPORARY CONSTRUCTION

- A. At the completion of the Work, the Contractor shall remove from the Project site all temporary utilities and services construction. Leave the Project site clean and free from debris, materials, or equipment.

**END OF SECTION 01 51 00**

**SECTION 01 52 00**  
**CONSTRUCTION FACILITIES**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Field Offices and Sheds
- B. Temporary Facilities
- C. Temporary Sanitary Facilities

1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK
- B. Section 013500 – SPECIAL PROCEDURES: General requirements for temporary facilities and temporary controls to accommodate University continued occupancy and use of the areas and spaces adjacent to construction.
- C. Section 017400 – CLEANING
- D. Section 017700 – CLOSEOUT PROCEDURES

1.03 TEMPORARY FACILITIES

- A. Contractor shall provide and maintain the following temporary facilities as required for execution of the Work:
  - 1. Scaffolding, staging, runways and similar equipment.
  - 2. Hoists or construction elevators, complete with operators, power and signals required.
  - 3. Temporary rigging, rubbish chutes, barricades around openings, ladders between floors, and similar equipment.
  - 4. Barricades, fencing, lights and similar safety precautions.
  - 5. Security cameras for remote video surveillance of the project site and 24/7 monitoring services that records and reports incidents and alarms. Security cameras to provide full coverage of the construction and storage site area.

- B. Maintenance: Use all means necessary to maintain temporary construction facilities and controls in proper and safe condition throughout progress of the Work.
- C. Replacement: In event of loss or damage, promptly restore temporary construction facilities and controls by repair or replacement at no change to the Contract Sum or the Contract Time.
- D. Conformance: All materials and equipment required to safely accomplish work under this Section shall be in conformance with requirements of CAL OSHA and other State and Federal Codes and regulations where applicable.
- E. Codes: All temporary work and facilities shall conform to the above requirements that pertain to operation, safety and fire hazard.
- F. Construction Site Security: Temporary barriers, doors and gates shall be keyed to University's master lock system. Security hardware to be provided by Contractor. Keying to University master lock system will be provided by University.

#### 1.04 TEMPORARY SANITARY FACILITIES

- A. Use of existing facilities: Designated toilet facilities may be used by Contractor.
  - 1. Assigned facilities: Location of assigned toilet facilities and maintenance of same are responsibility of University. Contractor shall not have exclusive use to these facilities and shall abide by health and safety criteria regarding their use and sanitary upkeep.
  - 2. Unassigned facilities: Unassigned toilet facilities shall not be used without written authorization of University's Representative.
  - 3. Contractor may use existing toilet facilities that are within the limits of the Work.
- B. Contractor shall pay service charges for connection and use of sewage utilities.
- C. Portable units: Enclosed, portable, self-contained units or temporary water closets and urinals, secluded from public view may be used. Self-contained units shall be approved by University's Representative prior to use.
  - 1. Contractor shall pay costs of installation, maintenance and removal of temporary sanitary facilities.
  - 2. Provide facilities at time of site mobilization.
  - 3. Modify and extend services as work progress requires.
  - 4. When utility services are available, provide water, sewer service, and temporary water closets; remove portable facilities. Remove temporary fixtures when permanent facilities are operational.
  - 5. Clean areas of facilities daily, maintain in sanitary condition. Disinfect fixtures, repair or replace damaged fixtures, accessories and surfaces.
  - 6. Provide toilet paper, paper towels, and soap in suitable dispensers.

7. Restore existing and permanent areas and facilities used to original condition. Remove all temporary construction facilities above and below grade. Leave the project site clean and free of debris, materials and equipment.

**PART II - PRODUCTS**

2.01 MATERIALS

- A. Serviceable, new or used, adequate for required purpose.

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 52 00**

**SECTION 01 55 00**  
**VEHICULAR ACCESS AND PARKING**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Construction Parking and Access Roads
- B. Traffic Regulation
- C. Project Informational Signs

1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK
- B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- C. Section 013500 – SPECIAL PROCEDURES: General requirements for temporary facilities and temporary controls to accommodate University's continued occupancy and use of the areas and spaces adjacent to construction.
- D. Section 017400 – CLEANING
- E. Section 017700 – CLOSEOUT PROCEDURES: Project Closeout.

1.03 PARKING AREAS AND ACCESS ROADS

- A. Access Roads: Existing roads shall be used for construction access within limits defined herein. Temporary construction access roads shall not be permitted.
- B. Parking: Parking is controlled and limited by University.
  - 1. Parking of personal vehicles belonging to Contractor employees may be arranged with University's Parking Services, at 916-734-2687. Parking will be allowed in employee permit areas, at the current permit rates depending on space availability.
  - 2. Delivery of materials may be made to the job-site as required. Contractor shall coordinate with University's Representative.
  - 3. Dumpsters shall be located in approved location as arranged by University's Representative.
- C. Existing Pavements and Parking Areas: Designated existing on-site streets and driveways may be used for construction traffic. Vehicles with metal tracks will not be allowed.
  - 1. Designated areas of existing parking facilities may be used by construction personnel. Do not allow heavy vehicles or construction equipment in parking areas.

2. Maintain traffic and parking areas in a sound condition, free of excavating material, construction equipment, products, mud, snow and ice.
3. Maintain existing and permanent paved areas used for construction. Repair existing facilities damaged by usage to original condition: promptly repair breaks, potholes, low areas, standing water and other deficiencies, to maintain paving and drainage in original or specified condition.
4. Remove temporary materials and construction when permanent paving is usable.

#### 1.04 TRAFFIC REGULATION

- A. Schedule of Access Closing: Contractor shall adopt all practical means to minimize interference to traffic. Access to other facilities in the area shall be maintained at all times. Contractor shall provide schedule of planned closing of any street for approval by University and shall give minimum of fourteen (14) calendar days' notice before closing any street or access.
- B. Use of Fire Lanes: Contractor shall notify University of all major pickups and deliveries that require use of controlled access fire lanes. Keys to gates or other barriers will be provided, as needed, to allow use of fire lanes. Vehicles parked in fire lanes for delivery of materials shall be continuously manned for immediate removal if required by the University.
  1. Fire Lanes to remain open at all times and shall not be blocked without a Traffic Control Plan provided prior to work at the Fire Lane and approved by the University's Representative.
- C. All major pick-up and delivery operations shall occur in total before or after normal working hours.
  1. Drawings may indicate haul routes designated by University for use of construction traffic. Confine construction traffic to haul routes.
  2. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.
- D. Post-mounted and wall-mounted traffic control and informational signs as specified herein.
  1. Traffic Control Signs, Traffic Message Boards, Cones, Drums, Flares, Lights and Flag Control equipment: All as approved by California MUTCD requirements.
  2. Contractor shall furnish at all barricades: Lights and flag control required to control traffic, and shall also provide and maintain suitable temporary barricades, fences, directional signs, or other structures as required for protection of the public; and maintain from the beginning of twilight throughout the whole of every night on or near the obstructions, sufficient lights and barricades to protect the public and/or the Work.
- E. Construction Vehicle Parking: Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and University's operations. Prevent parking on or adjacent to roads or in non-designated areas.



- F. Flag Control: Provide properly trained and equipped flagmen to regulate vehicular traffic when construction operations or traffic encroach on public traffic ways.
  - 1. Provide properly trained and equipped personnel to regulate pedestrian traffic at all interior locations where construction traffic interfaces with University traffic.
  - 2. Flag control personnel shall wear appropriate identifying clothing such as bright colored vests, clearly visible and identifiable as having responsibility for traffic control.
- G. Lights: Use lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- H. Traffic Signs and Signals: At approaches to site and on site, install traffic signs and signals at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
  - 1. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
  - 2. Relocate traffic signs and signals as Work progresses, to maintain effective traffic control.
  - 3. Remove equipment and devices when no longer required. Repair damage caused by installation.

1.05 PROJECT INFORMATIONAL SIGNS (If applicable or NOT USED)

- A. Project Identification Sign: Contractor shall provide one (1) project sign. Sign will consist of one (1) 8' x 4' x 3/4" exterior grade plywood with medium or high-density phenolic sheet overlay, painted plywood sign on fence area at construction field office or yard.
  - 1. Information on sign shall include PROJECT NAME, University of California, Davis Health, University's consultants, etc. Copy will be provided by the University.
- B. Painted Informational Signs: Provide at each field office, storage shed and yard, directional signs to direct traffic into and within site. Relocate as Work progress requires.
- C. Maintain signs and supports: Clean, repair deterioration and damages.
- D. Remove signs, framing, supports and foundations at completion of Project and restore the area.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION – Not Applicable to this Section**

**END OF SECTION 01 55 00**

## SECTION 01 56 00

### TEMPORARY BARRIERS, ENCLOSURES and CONTROLS

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Barriers and Enclosures
- B. Protected Walkways and Weather Closures
- C. Tree and Plant Protection
- D. Temporary Controls

##### 1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK
- B. Section 013500 – SPECIAL PROCEDURES
- C. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION
- D. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- E. Section 017400 – CLEANING

##### 1.03 BARRIERS AND ENCLOSURES

- A. Barricades: Provide to prevent public entry, to protect existing trees and plants, and to protect existing facilities and adjacent properties from damage during construction period. Relocate and extend as construction progress requires per California MUTCD requirements.
- B. Partitions and Ceiling Enclosures:
  - 1. Fire Enclosures-Rated-Corridors and Rated Assemblies: Provide non-combustible dust-proof barrier framed with 20-gauge metal studs spaced 24" o/c maximum and covered on both sides with  $\frac{5}{8}$ " thick Type-X rated gypsum wallboard fire taped, braced so to be self-supporting without fastening to existing finishes.
    - a. Provide gaskets of closed cell neoprene, or strips of fiberglass insulation between barriers and existing finish.

- b. Finish exposed surfaces with two (2) coats of paint (color as selected by University), maintain in neat, orderly appearance and paint barrier on public side. Temporary emergency exit and or directional signage indicating Emergency Exits will be furnished and installed by Contractor.
  - c. Provide temporary doors in corridors with twenty (20) minute fire-rated assemblies and locksets to limit use.
  - d. Use of access doors and routes by workmen to be approved by University's Representative.
2. Fire Retardant Enclosures - Non-Rated Assemblies: Provide non-combustible dust-proof barriers framed with metal studs and covered on public side with Fire Retardant plastic laminate sheathing material. Flame spread 10 - smoke development 45 - fuel contribution undeterminable, as manufactured by Reef Industries, Inc., P.O. Box 33248, Houston, TX77033 or equal.
- a. Joints shall be taped and sealed over framing studs.
  - b. Bracing shall be self-supporting without fastening to existing finishes.
  - c. Provide gaskets of closed cell neoprene, or strips of fiberglass insulation between barriers and existing finishes.
  - d. Provide non-staining taped seal to surrounding materials to insure seal.
  - e. Non-Rated Assemblies for Dust Control: Use ½" Type-X or equal gypsum wallboard applied on occupancy side on framing member. Joints over studs shall be taped and sealed. Other detail similar to 1.03-B.2 above.
- C. Removal: Remove temporary materials, equipment and construction at completion; repair damage caused by installation or use of barricades and enclosures. Restore existing facilities used during construction to specified or to original condition.

#### 1.04 DIESEL VEHICLE/EQUIPMENT IDLING PROCEDURES

- A. When drivers of diesel powered on-road vehicles arrive at loading or unloading areas to drop-off or pick-up passengers, supplies, equipment, materials, etc., they shall turn off their vehicle's engine as soon as possible but no later than five minutes after arrival.
- B. Operators of off-road diesel-powered equipment shall turn off their engines when the equipment is not performing its primary function, but no later than five minutes after the equipment has come to a stop.
- C. Idling for "warm-up" prior to diesel vehicle or equipment operations on University property shall be limited to a maximum of five minutes.
- D. At end of work shift, or for the purpose of servicing, all diesel equipment shall be parked on site at furthest location away from Hospital air intake systems.
- E. All diesel-powered equipment shall be maintained in good operating condition. University representative will direct Contractor to remove any equipment producing high amount of diesel fumes resulting from diesel equipment being old or in poor operating condition.

1.05 PROTECTED WALKWAYS AND WEATHER CLOSURES

- A. Cover walkways to provide access to existing facilities for use by public and University personnel.
- B. Provide temporary roofing and weather-tight insulated closures of openings in exterior wall surfaces, to maintain specified working conditions, to protect products and finished work from inclement weather.
- C. Critical access and protected walkways shall comply with the CBC and CFC.

1.06 TREE AND PLANT PROTECTION

- A. Tree Protection: All trees not marked for removal shall be protected against damage from construction operations. Where necessary, in the opinion of University's Representative, trees surrounding building footprint or in close proximity to construction operation shall be protected with barricades. No trees shall be cut or felled without approval of University's Representative. Trees cut and/or removed without explicit instruction shall be replaced by Contractor at no cost to the University.
- B. Cutting and Pruning: Cutting and pruning of trees to accommodate construction shall be done only with approval and direction by University's Representative. Soil within the spread of tree branches (within drip line) shall not be disturbed except as directed by excavation or trenching drawings. Advance notice shall be given University if tree roots of 3" diameter or greater must be cut.
- C. Drip line Protection: Cars, trucks, or equipment shall NOT be parked or set within the drip line of any tree; nor shall there be any stockpiling or temporary building erected within the drip line.

1.07 TEMPORARY CONTROLS

- A. Dust Control: Contractor shall take appropriate steps throughout project to prohibit airborne dust due to work under this contract. Execute work by methods to minimize raising dust from construction operations. Water shall be applied wherever practical to settle and hold dust to minimum, particularly during demolition and moving of materials. No chemical dust prohibitor shall be used without written approval by University's Representative.
- B. Noise Control: Control noise as directed by University's Representative.
- C. Pollution Control: Use of noxious or toxic materials for all applications in alterations or work in buildings occupied by University personnel shall be done after proper notification and approval by University, this includes work performed on weekends or other unoccupied times.
  - 1. Provide methods, means and facilities to prevent contamination of soil, water and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

- D. Waste Control: All waste materials resulting from process of clearing and construction shall be disposed of as follows:
1. General Refuse: All refuse and debris, combustible and incombustible, resulting from construction process, shall be removed from University property as described in the General Conditions of the Contract. Contractor shall not use any refuse container belonging to University.
  2. Hazardous Refuse: Solvents, oils and any other hazardous material shall be disposed of in containers and removed from site. At completion of work, any contaminated soil shall be removed and replaced with good soil by Contractor at no expense to University. Coordinate disposal with UC Davis Health EH&S department.
  3. Building materials containing asbestos that are part of the project shall not be disturbed or removed by the contractor during the construction of temporary barriers, enclosures and controls. The contractor shall request from the University's Representative materials that have been identified on the project to contain asbestos so that these materials are not disturbed. The contractor shall refer to Section 013500 Special Procedures, 1.05 Hazardous Materials Procedures regarding materials impacted by construction of temporary barriers, enclosures and controls.
  4. All material and equipment removed as part of the Project is property of University, unless specifically designated otherwise; such material and equipment shall be delivered to a location at the campus, as directed by University, to be selectively sorted by the University; remaining debris shall be disposed of by Contractor at no expense to University.
- E. Drainage Control: All portions of Work shall be kept free of standing water at all times during construction. Where required, temporary drainage ditches, berms, or pumping systems shall be constructed to divert drainage water from construction site, and resultant water shall be carried to nearest natural water course and disposed of without erosion to surrounding area. Care shall be taken to prevent silting of existing sinkholes and watercourses. Silt deposited as a result of the Work shall be removed and disposed of by Contractor at no cost to the University.
1. Rough grade site to prevent standing water and to direct surface drainage away from excavations, trenches, adjoining properties and public rights-of-way/s.
  2. Maintain excavations and trenches free of water. Provide and operate pumping equipment of a capacity to control water flow.
  3. Provide de-watering system and pumping to maintain excavations dry and free of water inflow on a twenty-four (24) hour basis.
  4. Provide piping to handle pumping outflow to discharge in manner to avoid erosion or deposit of silt. Provide settling basins to avoid silting; install erosion control at out-falls of system.
  5. Winterize and stabilize site with Geotextile Fabric and gravel so that the site drains and avoids it becoming a quagmire. Maintain access roads on the site with Geotextile Fabric and gravel and make repairs to avoid furrow, ruts, or potholes.
  6. Remove equipment and installation when no longer needed.

- F. Sediment and Erosion Control: Contractor shall furnish, install and maintain means and methods to reduce excessive erosion, minimize sedimentation discharge, and prevent construction materials discharge from causing off-site and on-site contamination. Contractor shall coordinate with University.
1. Contractor shall pay for and maintain required permits.
  2. Contractor shall furnish:
    - a. National Pollutant Discharge Elimination (NPDE) permit.
    - b. Contractor shall file Notice of Intent to California State Water Resources Control Board (SWRCB) stating date construction will begin. Provide copy to University.
    - c. Contractor shall prepare, maintain and follow Storm Water prevention Plan. The Plan shall include Contractor's Best Management Practices (BMP) describing means and methods to control sediment, erosion and other pollutants.
    - d. Contractor shall keep BMP Program at jobsite.

## PART II - PRODUCTS

- 2.01 Polyethylene: Polyethylene used for critical barriers and for sealing walls, floors or ceiling systems shall be a minimum of 6 mil thickness and fire-retardant type listed by Fire Underwriters Laboratories, Griffolyn #T55R with Griffolyn fire retardant tape, or equal.

## PART III - EXECUTION

- 3.01 Infection Control Risk Assessment ICRA Requirements:

- A. \*\*\*\*DELETE SECTION IF NON-PATIENT CARE SPACE\*\*\* NON-CLINICAL DUST CONTROL COVERED BY 1.03\*\*\*
1. Refer to attached Infection Control Risk Assessment (ICRA) and UC Davis Health Construction Dust & Hazardous Materials Inspection Worksheet.
    - a. These documents dictate minimum requirements for Class I and II containments and minimum requirements that must be completed to control dust during construction.
      - 1) Mini containments (pop-up cubes) which are designed to have at most 1-2 people may be used in lieu of custom-built Class II Containments.
  2. The outside of the work containment shall have present: ICRA Permit, Interim Life Safety Measure (ILSM) Permit, Daily ICRA Inspection Forms, entry warning sign, Containment Entry Log (provided by the contractor) that lists all persons who enter the containment regardless of affiliation, including all University employees, and an emergency telephone number of persons to call 24 hours.
  3. Before any demolition or construction begins, all Protection Areas (infection control areas), control measures put in place and work plan by the Contractor will be

inspected by a designated University representative. Work cannot begin until the work containment has been inspected and approved.

3.02 Refer to the following Attachments:

- A. Appendix A - Construction Dust & Hazardous Materials Inspection Worksheet
- B. Appendix B - Initial Information and Benchmark Containment Inspections
- C. Appendix C - Entry Warning Sign with Project Manager Contact Information

**END OF SECTION 01 56 00**

**UC DAVIS HEALTH CONSTRUCTION DUST & HAZARDOUS MATERIALS INSPECTION WORKSHEET – APPENDIX A**

|                    |                      |
|--------------------|----------------------|
| ICRA Permit Number | ICRA Class           |
| Job # and Name     | Project Manager      |
| Estimated Start    | Estimated Completion |

**ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS**

|   |          |
|---|----------|
| Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)? | Yes / No |
| Verified How: (e.g., hazmat survey, personal knowledge)                                   |          |
| By Whom: (name & department)  |          |

**CONTAINMENT STRATEGIES**

|   |  |                          |                           |
|---|--|--------------------------|---------------------------|
| <b>Enclosure Types [check all that apply]</b>                     |  |                          |                           |
| <input type="checkbox"/>  | Full Containment (poly over all surfaces not in SOW)   | <input type="checkbox"/> | Hard Barriers Required    |
| <input type="checkbox"/>  | Isolated Room – Critical Openings Only (seal doors, supply and return registers, etc)                                      |                          |                           |
| <input type="checkbox"/>  | Mini Containment Cube (only large enough for 1-2 people; aka pop up cube)  |                          |                           |
| <input type="checkbox"/>  | Shrouded Tool with HEPA filtered exhaust   |                          |                           |
| <input type="checkbox"/>  | Glove Box Containment with HEPA filtered exhaust   |                          |                           |
| <input type="checkbox"/>  | Other:   |                          |                           |
| <b>Negative Pressure Requirements [check all that apply]</b>      |  |                          |                           |
| <input type="checkbox"/>  | -0.020" wc at all times (24/7) as displayed on mounted manometer   |                          |                           |
| <input type="checkbox"/>  | -0.020" wc at setup with some negative pressure throughout project as displayed on manometer                               |                          |                           |
| <input type="checkbox"/>  | Visual Verification of some negative room pressure throughout project  |                          |                           |
| <input type="checkbox"/>  | No negative room pressure required   |                          |                           |
| <input type="checkbox"/>  | Negative pressure in localized HEPA exhausted work area (e.g. shrouded tool, glove box)                                    |                          |                           |
| <input type="checkbox"/>  | Other:   |                          |                           |
| <b>Negative Pressure Equipment [check all that apply]</b>         |  |                          |                           |
| <input type="checkbox"/>  | Onsite Challenge Testing (DOP or particle counting) prior to setup   |                          |                           |
| <input type="checkbox"/>  | Challenge Tested within last 6 months; Equipment has remained onsite at University   |                          |                           |
| <input type="checkbox"/>  | Single HEPA Unit; exhausted to: <input type="checkbox"/> Outdoors <input type="checkbox"/> Diffusion Box/Chamber           |                          |                           |
| <input type="checkbox"/>  | Two HEPA Units in Parallel; exhausted to: <input type="checkbox"/> Outdoors <input type="checkbox"/> Diffusion Box/Chamber |                          |                           |
| <input type="checkbox"/>  | Other:   |                          |                           |
| <b>Additional Containment Requirements [check all that apply]</b> |  |                          |                           |
| <input type="checkbox"/>  | Ante Room  | <input type="checkbox"/> | Masonite Floor Protection |
| <input type="checkbox"/>  | Protective Clothing  | <input type="checkbox"/> | Air Scrubber              |
| <input type="checkbox"/>  | Walk off mats  | <input type="checkbox"/> | Shoe Covers               |
| <input type="checkbox"/>  | Other:   |                          |                           |

**VERIFICATION OF WORK**

| Type(s) of Inspection Required                  | Responsible Party  |
|---|--|
| HEPA Equipment Verification                     | <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> Other:  |
| Pre-Work Approval Inspection                    | <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> Other:  |
| Daily Onsite Oversight                          | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |
| Air Sampling<br>Type: _____<br>Frequency: _____ | <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> Other:  |
| Demolition Inspection                           | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |
| ICRA Downgrade                                  | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |
| Final Visual Approval Inspection                | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |



**INITIAL INFORMATION AND BENCHMARK CONTAINMENT INSPECTIONS – APPENDIX B**

| ICRA # | Location | Set Up Date | Electrical Shop Inspection | Pre-Start Inspection (Name, Date, Time) | Post-Demo Inspection (Name, Date, Time) | Downgrade Inspection (Name, Date, Time) | Final Inspection (Name, Date, Time) | Take Down Date |
|--------|----------|-------------|----------------------------|---|---|---|-------------------------------------|----------------|
|        |          |             |                            |   |   |   |                                     |                |

**DAILY INSPECTION LOG**

(Sheet \_\_\_\_ of \_\_\_\_)

| Date & Time              | Performed By(Name) | Pressure Reading (+/-) | Acceptable Negative Pressure? (Y/N) | ILSM conditions still met? (Y/N/n/a) | Tack Mat useable? (Y/N) | Interior free of dust/debris? (Y/N) | Containment Integrity Intact (no holes or breaches)? (Y/N) | All ICRA permit conditions met? (Y/N) | Other Issues? (Explain) | Corrective Actions |
|--------------------------|--------------------|------------------------|-------------------------------------|--------------------------------------|-------------------------|-------------------------------------|--|---------------------------------------|-------------------------|--------------------|
| Example<br>7/4/16 – 0800 | B. Clean           | -0.025                 | Y                                   | Y                                    | Y                       | Y                                   | Y  | Y                                     | N                       | closed entry door  |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |
|                          |                    |                        |                                     |                                      |                         |                                     |  |                                       |                         |                    |

**ENTRY WARNING SIGN WITH PROJECT MANAGER CONTACT INFORMATION – APPENDIX C**

**CONSTRUCTION DUST PRECAUTIONS IN USE  
DO NOT ENTER**

**For More Information Contact the Project Manager**

\_\_\_\_\_  
**(Name)**

\_\_\_\_\_  
**Phone Number**

**(THIS SIGN MUST BE POSTED IN COLOR)**

## SECTION 015610

### AIRBORNE CONTAMINANTS CONTROL

#### PART I - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: University airborne contaminants control policy procedures and an Infection Control Risk Assessment (ICRA) and plan.

##### 1.02 POLICY

- A. Airborne contaminants control is critical in all hospital areas, as well as non-hospital areas. **Contractor** shall limit dissemination of airborne contaminants produced by construction-related activities, including dust, chalk, powders, aerosols, fumes, fibers and other similar materials, in order to provide protection of immuno-compromised and other patients, staff, diagnostic operations, or sensitive procedures or equipment, from possible undesirable effects of exposure to such contaminants.
  - 1. Construction activities causing disturbance of existing dust, or creating new dust, or other airborne contaminants, must be conducted in tight enclosures cutting off any flow of particles into patient areas.
  - 2. Ceilings, walls in Protection Areas and other areas in patient care areas as indicated on drawings must be secure at all times.
- B. An Infection Control Risk Assessment (ICRA) and plan to mitigate dust or other airborne contaminants is required for each project. The risk assessment identifies patient groups at risk for infection due to construction dust. The dust mitigation plan is designed to contain dust within the construction zone.
- C. All work at hospital facilities shall follow the recommended UC Davis Medical Center Construction Dust Infection Prevention Best Practices Standard, Version 4.0 – December 2022 or the most recent version.
- D. Should the scope of work change or the discovery of additional toxic materials such as asbestos, lead and radioactive materials or biological substances such as visible mold growth, STOP WORK and seek additional approval and guidance before proceeding. If the above potential materials newly discovered during construction, renovation, or repairs, any ICRA in-hand is invalid and risk assessment shall be performed to reevaluate ICRA levels and the work plan prior to restart of the work. Upon discovering, seal any openings, stop work and notify the University's Representative immediately. This includes projects that are already considered and operating under a Class IV.
- E. Related Sections:
  - 1. Section 017300 – CUTTING AND PATCHING: Removal of debris may be outside of normal work hours and shall be in tightly covered containers.
  - 2. Section 013500 – SPECIAL PROCEDURES: Perform work in accordance with requirements of this section.

3. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION
4. Section 015100 – TEMPORARY UTILITIES: Provide high efficiency particulate air (HEPA) filters as specified in Section 015610, negative pressure ventilation, or special control of existing system as determined by University's Representative.
5. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS: Extend barriers above ceilings as required to seal off and contain airborne contaminants.
6. Section 015600 – TEMPORARY CONTROLS: Contain waste materials during removal; bagging, wrapping, and transporting.
7. Section 017400 – CLEANING: Use wet cleaning methods and HEPA filtered vacuum cleaners as required to minimize release of airborne contaminants. Contain waste materials, debris and rubbish as noted above and clean work area daily. Excess construction debris shall be cleaned daily by the end of each work shift. Disinfect Containment and Protection Areas as directed by University's Representative

F. Dust Mitigation Requirements

1. An ICRA Daily Inspection Log ~~Compliance Survey~~ is attached at the end of this section under UC Davis Health Construction Dust Infection Prevention Best Practice Standard. The **Contractor** must complete this daily checklist and leave posted for the duration of the project at the outside of the containment. Any areas of non-compliance must be specifically listed and addressed for corrective measures when identified. A copy of the daily ICRA inspections shall be submitted to the University's Representative at an agreed upon time between the **Contractor** and the Project Manager.

G. UC Davis Health Construction Dust Infection Prevention Best Practice Standard

- a. The UC Davis Health Construction Dust Infection Prevention Best Practice Standard is attached at the end of this Section and augments information & requirements of Section 015610.
- b. Refer to the UC Davis Health Construction Dust Infection Prevention Best Practice Standard per requirements for.
  - 1) Responsibilities
  - 2) Procedures
  - 3) Training And Certifications
  - 4) Containment Design & Construction
  - 5) Materials And Equipment
  - 6) Cleaning Procedures
  - 7) Documentation
  - 8) Containment Verification

- 9) Inspection Criteria
- 10) And other Dust Infection Prevention Measures

### 1.03 SUBMITTALS

- A. Submit to Project Inspector or Post at Anteroom Daily ICRA Inspection Log.
- B. Schedules: Submit work areas and procedure schedules for containment of airborne contaminants. Include this work in the Project Schedule per 013200.
- C. Detailed Work Plan: Drawings including but not limited to Work Area/ Floor Plan, Path of Travel, Egress and Exiting, Rated Construction and details of construction of necessary temporary barriers, and description of procedures to be used to achieve and maintain control of construction-related airborne contaminants.
  - 1. As applicable, the drawing should include the following: location of ante room(s), location of manometer, location of negative air units exhausting outside the construction area including number of negative air units and sizes (cfm), and location of sealed blocked off areas of corridors. If the exhaust of the negative air unit(s) cannot be exhausted outside of the building, the work plan shall include details, product documents and drawings of the approved fire-rated assemblies that will be used to meet Fire Codes (if applicable), Building Codes and ILSM requirements. Any impacts to corridors will need to be approved via ILSM (see specification section 013500 for details).
  - 2. Identify the areas surrounding the project area, assessing potential impact of construction on the patient care area. Identify the specific uses (e.g., patient rooms, medication room, operating room, etc.)
  - 3. Identify the potential impacts including but not limited to.
    - a. HVAC, Ventilation (outages, air flow directions, clean to dirty, air intakes/exhausts, air balance, disruptions, etc.).
    - b. Plumbing (outages, hand-washing access, work area, flushing/draining systems, charging systems, disinfecting systems, etc.).
    - c. Electricity (outages for critical equipment, special ventilation areas, monitoring).
    - d. Identify Airborne infection isolation rooms and patient rooms with immunocompromised conditions that will require High-efficiency Particulate Air (HEPA) filters.
  - 4. Identify containment measures including but not limited to types of barriers to be used. HEPA filtration to be used. Renovation/construction areas should be isolated from occupied areas during construction and provide clean-to-dirty airflow with respect to surrounding areas.
  - 5. Assess preventive maintenance requirements. Will the service/maintenance frequency and level of service of systems need to be modified during construction (e.g., ventilation filters, air intake system, potable water, plumbing, doors). Work Hours: Can or will the work be done during non-patient care hours?

6. Include provisions for but not limited to traffic flow, entrance, egress, control, debris removal and housekeeping.
  7. Work Hours: Identify areas of work that will be done during non-patient care hours. Refer to Sections 011100 Summary of Work and Section 011400 Work Restrictions
  8. The Detailed Work Plan shall be reviewed and approved by the University's Representative prior to the start of Construction.
- D. Project Experience and Training: In order to be considered qualified to work with negative pressure containments; Contractor's must demonstrate experience by providing either of the following:
1. Previously completed, documented negative pressure containment work in a healthcare facility along with an owner reference. Minimum documentation shall include project descriptions and photographs or containment schematics.
  2. Documentation that the contactors' proposed foreman has successfully obtained one of the following from the American Society for Healthcare Engineering (ASHE):
    - a. Certified Healthcare Constructor (CHC) Certification
    - b. Health Care Construction (HCC) Certificate
    - c. Managing Infection Prevention During the Construction & Operation of Health Care Facilities Course Completion
    - d. Completion of an ICRA training course approved by University
  3. Documentation that all contractor employees and subcontractor's employees have successfully completed an ICRA training class that is approved by University. All personnel working with negative pressure containments shall be trained and knowledgeable in the following:
    - a. ICRA Permit contents and requirements
    - b. Site specific containment plan requirements that follow best management practices
    - c. Infection risks associated with construction
    - d. Methods to control the dissemination of dust and fungal spores
    - e. Proper use of protective clothing
    - f. Proper entry and exit procedures
    - g. Manufacturer's requirements, where manufactured containment systems are used (e.g., portable pop-up cubes)
    - h. How to respond to a loss of negative pressure or too much negative pressure
    - i. Breach in practice response and required notifications

4. Contractors shall be additionally trained in the following:
  - a. Proper containment design, construction, and maintenance techniques
  - b. Proper load out techniques for equipment/wastes
  - c. Containment cleaning regime: daily, final, and terminal cleaning
5. Containment failure emergencies caused by the contractor may require retraining at the discretion of the University's Representative Infection Control, or Environmental Health & Safety. Training is to be provided by University Environmental Health & Safety or a University approved training consultant.

#### 1.04 QUALITY CONTROL

- A. Pre-construction Meeting: Before any construction on site begins, Contractor's Superintendent is required to attend a mandatory pre-construction orientation session held by University's Representative for a review on precautions to be taken as required in their ICRA work plan.
- B. Review by PO&M HVAC staff for possibility to disconnect air supply and return into the project area
- C. Review by University Plant Operation & Maintenance Electrical staff for required electrical needs.
- D. Negative air machines shall be connected to separate electrical circuits.
- E. Notification: A minimum of fourteen (14) calendar days written notification to University's Representative of possible construction activity causing airborne contaminants in Protection Areas.

#### 1.05 DEFINITIONS

- A. Containment Areas: As determined by University's Representative and if shown. Includes all areas of construction activities, adjacent staging and storage areas, and passage areas for workers, supplies and waste. The containment area includes ceiling spaces above and adjacent to construction activities.
- B. Critical Openings – Include all potential paths for air and contaminants to move from the project area to outside of the project area and include: supply registers, return registers, exhaust registers, doors, windows, electrical outlets, gaps at ceilings and other openings within the area where contaminants can escape. Sealing the critical openings can be accomplished with fire-rated tape, fire-rated plastic, fire-rated hard barriers and a combination of these materials to seal airtight the critical opening.
- C. HEPA System DOP Testing – An ANSI / ASTM recognized method to test the integrity of a High Efficiency Particulate filter which filters out 99.97% of particles 0.3 micrometers or larger. DOP testing is performed by specialty Contractor's. The Health System requires that HEPA systems be tested to the ANSI / ASTM standard as delivered prior to their use onsite as further described in this Standard.

- D. ICRA (ICRA) Infection Control Risk Assessment - An evaluation of patient risk based on a matrix of the patient population health in the work area and the invasiveness of the project. This assessment ultimately generates a permit (ICRA permit) issued by Infection Prevention requiring compliance with one of five precaution levels. The ICRA program is documented in Hospital P&P 2120. ICRA's apply to patient care areas and their adjoining contiguous areas. All ICRA evaluations are the sole responsibility of the Health System Infection Prevention Department based on an application by the Project Manager. ICRA Permits expire and can be extended subject to approval by the Infection Prevention Department.

#### 1.06 PERFORMANCE REQUIREMENTS

A. University's Representative's Responsibilities:

1. Determination of the Containment and Protection Areas, as well as, the standard of limitations of the Contractor's responsibilities, required for the project.
2. Statement of Requirements: Description in graphic and written form as required to communicate the above based on evaluation of the construction area and the impact of the project on patient care.
3. Coordinate any testing and monitoring as necessary with EH&S or a third party.

B. **Contractor** Responsibilities:

1. Provide specific means and methods of achieving and maintaining control of airborne contaminants during construction.
2. Implement all mitigation measures as listed in the UC Davis Health Construction Dust & Hazardous Materials Inspection Worksheet, which have been reviewed and approved by Infection Prevention and EH&S. The work shall be performed in accordance with the specific ICRA/Dust Mitigation Plan, Class (I, II, III or IV) and approved ICRA Permit.
3. **Contractor** shall ensure that all workers are trained and adhere to the mitigation requirements including provisions indicated per UC Davis Health Construction Dust Infection Prevention Best Practice Standard attached at the end of this Section.
4. The contractor shall ensure that all site workers, including subcontractors, are knowledgeable of the requirements of plans, specifications and approved ICRA permit precautions and the reasons for controlling construction dust.
5. The contractor is required to stop work at times of excessive noise/vibration, when containment is breached, when this standard is not being complied with and when directed by University Representatives.
6. **Contractor** shall notify University's Representative in writing, a minimum of fourteen (14) calendar days prior to starting construction activity, which might be expected to produce excess levels of airborne contaminants in containment area so that additional precautions may be taken.



7. If project construction activities will occur beyond the expiration date identified in the ICRA Permit, **Contractor** shall coordinate with University's Representative to request extension of the ICRA Permit utilizing the ICRA 2.0 Permit Form attached ~~provided~~ at the end of ~~in~~ this section.

## **PART II - PRODUCTS**

### 2.01 MATERIALS

- A. Polyethylene: Polyethylene used for critical barriers and for sealing walls, floors or ceiling systems shall be a minimum of 6 mil thickness and fire retardant type listed by Fire Underwriters Laboratories, Griffolyn #T55R with Griffolyn fire retardant tape, or equal.
- B. Approved one-hour fire-rated temporary containment systems that meet ASTM E84, Class A requirements for smoke and fire for fire rated assemblies/enclosures.
- C. Fire-rated tape for sealing critical barriers and attaching plastic to building components.
- D. Approved fire damper systems used to control smoke/fire in a fire-rated containment assembly.

## **PART III - EXECUTION**

3.01 PROJECT SPECIFIC REQUIREMENTS: The below criteria shall be applied on a case by case basis as outlined in the project specific requirements, ICRA Permit(s), and EH&S Worksheet(s)

- A. PM TO MODIFY THIS SECTION. ATTACH ICRA PERMITS, EH&S WORKSHEETS, OR ANY OTHER APPLICABLE DOCUMENTATION
- B. THE BELOW LISTED CRITERIA ARE POSSIBLE STRATEGIES FOR CLASS 3 AND 4 CONTAINMENTS. NOT ALL OF THE STRATEGIES WILL BE ALLOWED OR REQUIRED. THE ICRA PERMIT AND EH&S WORKSHEET DEFINE WHAT IS ALLOWABLE. THINK OF THE ICRA PERMIT AND EH&S WORKSHEET AS A MENU. THE BELOW IS A DETAILED DESCRIPTION OF EACH ITEM ON THAT MENU.

### 3.02 CONTAINMENT CRITERIA

- A. The outside of the work containment shall have present: ICRA Permit, Interim Life Safety Measure (ILSM) Permit, Daily ICRA Inspection Forms, manometer, entry warning sign, Containment Entry Log (provided by the Contractor) that lists all persons who enter the containment regardless of affiliation, including all University employees, an emergency telephone number of person to call 24 hours a day in the event of a negative pressure alarm or other issue, and that an Environment of Care Incident Report under the category of "Construction Dust" must be filed by area nursing management in case of constant or annoying alarms.
- B. The interior of the containment area shall be cleaned on a continual basis daily. Hard surface floors in work area, adjacent hallways and passage areas require vacuuming with HEPA-filtered vacuum cleaners and frequent wet-mopping during demolition and construction; protect adjacent carpeted areas with plastic and plywood and vacuum with HEPA-filtered vacuum cleaners. Only an EPA Listed Germicide approved by the UC Davis Health Infection Prevention shall be used on the project site.
- C. Contractor shall inspect the containment daily prior to starting work and immediately repair any breaches, holes, or other issues.

- D. For projects of extended length when work activity is not being performed, including on weekend or holiday periods, and if the work area had a very thorough surface cleaning and received a passing visual inspection by a third party environmental consultant, the daily inspections are not required. At a minimum, ICRA inspections shall be made weekly for containments on projects of extended non-work activity.
- E. Regardless of containment strategies, execute work by methods to minimize raising dust from construction operations. Water may be used to assist in controlling airborne dust.
- F. Full containment
  - 1. All surfaces in the containment area except surface where work is to occur must be covered in plastic unless they are non-porous, smooth, and accessible for cleaning.
  - 2. Sealing of Openings: Use firerated tape or other impenetrable sealant to seal barrier wall seams, cracks around window and door frames, exhaust system ductwork, pipes, joints and ducts. Use of spray glue is not acceptable to be used inside of the building.
  - 3. **Contractor** must block off existing ventilation supply registers, return registers and exhaust registers in the construction area as critical barriers. Materials used to block off these critical barriers in a temporary construction area not exceeding 30 days may be constructed of 6-mil fire-rated plastic. Materials used to block off these critical barriers in a construction area exceeding 30 days shall be constructed of an approved fire-resistive material other than 6 mil plastic.
  - 4. All polyethylene (plastic) and other materials used for temporary enclosures shall be at least 6 mil thickness and fire-retardant type. Zip poles or other easily removable supports shall be used for projects extending beyond one work shift. Temporary walls with metal stud framing may be required for long term projects and must be approved by the Project Manager. All doors leading into the containment area shall utilize zippered doors for control of the air flow and closing the plastic doors. Flapped doorways consisting of overlapping plastic are not acceptable in the building.
  - 5. Creation of the negative pressure enclosure includes the requirement to complete temporary barrier walls in the attic space from the top of the ceiling to the underside of the roof deck in the project area when the ceiling system is opened.
  - 6. Creation of negative pressure enclosure includes sealing wall cavities that are opened to prevent air transmission between adjacent spaces and the attic space that has air pathway to the attic space.
  - 7. For temporary construction projects that do not exceed 30 calendar days, temporary work area containments may be constructed of 6-mil fire-rated polyethylene. Approval for this shall be by the Fire Marshal.
  - 8. For projects that exceed 30 calendar days, all barriers used to construct the temporary containment systems in the project area shall be hard barriers that meet the ASTM E84, Class A requirements for smoke and fire. This will include the use of a hard door integral to the temporary containment system to allow access and egress to and from the construction area.

9. Smoke detectors that are present inside of the construction work area can be temporarily covered during the work shift with a loose-fitting plastic “shower cap” that is commonly used on projects to prevent smoke alarms from inadvertently being triggered from dust. If this temporary dust control measure is used, the plastic covers shall be removed at the end of each work shift.
- G. Critical seal of areas
1. Use tape or other impenetrable sealant to seal barrier wall seams, cracks around window and door frames, exhaust system ductwork, pipes, joints and ducts. Use of spray glue is not acceptable to be used inside of the building.
- H. Double Ante Rooms with Negative Air Unit Attached to One Ante Room
1. In some locations when the negative air exhaust cannot be directed outside the building, and while temporary barriers are being installed, use of two anterooms connected in series to the construction zone may be used temporarily until full negative pressure containment is achieved. The use of double anterooms is a temporary measure and shall not be considered a primary means of negative pressure for control of dust. It must receive approval by Infection Prevention or EH&S before it can be considered. The configuration includes two anterooms connected with the clean anteroom accessible from the corridor, room, or space to access the project area. The second anteroom is connected to the construction work area.
  2. If approved, a HEPA filtered negative air unit shall be attached to the anteroom that is connected directly to the construction work area. This anteroom is considered the “dirty” anteroom because air is drawn into this room from the construction area. The first anteroom accessible from the corridor, room or space is considered a “clean” anteroom because air is unidirectional, moving into the second anteroom.
- I. Cubes
1. Mini-containments (pop-up cubes) which are designed to have at most 1-2 people are means of control to access attic spaces, wall spaces and subfloor spaces usually at defined entry points such as access hatches or above a drop-in ceiling system. Cubes shall have a HEPA filtered negative air unit attached or integral to the cube to create a negative pressure work environment inside of the cube. Cubes are reviewed and approved by the University’s Representative on a case by case basis.
- J. Glove Boxes
1. A glove box can be used for some work where a HEPA filtered vacuum is attached to the glove box when a small area of work is to be performed. A glove bag is attached to the box enclosure to allow the worker to make small openings by drilling or cutting within the negative pressure glove box. Glove boxes are reviewed and approved by the University’s Representative on a case by case basis.
- K. Shrouded tools
1. Shrouded tools can be used for some work. A HEPA (DOP Tested) filtered vacuum is attached to the shroud. Shrouded tools are reviewed and approved by the University’s Representative on a case by case basis.

3.03 NEGATIVE AIR CRITERIA

- A. HEPA filtered air shall not be discharged into existing HVAC supply ducts, return ducts, exhaust ducts or building plenum spaces unless there is a dedicated exhaust duct available in the construction project area and is approved for use by the University Plant Operations & Maintenance.
- B. The University's Representative shall determine if there is available a dedicated exhaust duct within the project area that is not connected to other exhaust ducts for exhaust out the building. This option can be considered if there are no other ducts attached to the exhaust duct, since other systems attached to the main exhaust duct might be pressurized, changing designed exhaust volumes, or creating back flushing of air in other connected ducts. Use of this option shall be reviewed and approved by University Plant Operations & Maintenance.
- C. When the air from the HEPA filtered negative air unit exhaust cannot be directed outside of the building due to no windows in the vicinity of the work or if impractical, all HEPA filtered negative air units shall be exhausted to a location agreeable to the PM. Each HEPA unit shall be plugged into a separate electrical circuit to provide temporary redundancy should one unit fail or due loss of electrical power. The PO&M Electrical shop shall inspect and test each circuit connected to the HEPA negative air unit prior to use.
- D. If negative air exhaust is required to be exhausted through a fire-rated assembly, the air shall be directed through approved fire-rated temporary containment systems that meet ASTM E84, Class A requirements for smoke and fire.
- E. When the air from the negative air units is exhausted inside of the building, the exhaust air from negative air unit shall be directed into a "diffusion cube" constructed of pleated filters to disperse the air in a manner that does not raise dust or blow air directly onto patients, staff or visitors. The **Contractor** shall consider and install charcoal filters in the negative air units to control smells/odors associated with the construction.
- F. Negative air units shall be positioned as far from the entry ante room containment as possible for distribution of air flow throughout the project area. The number of negative air units shall be to provide sufficient negative pressure and for a minimum of at least four (4) air changes per hour of the volume of the entire work containment.
- G. Dual HEPA Units operating in parallel may be required for redundancy in high-risk areas.
- H. DOP testing of HEPA equipment
  - 1. Negative air units and HEPA filtered vacuums are to be challenge tested onsite by the DOP test method by a third party prior to being placed in service, after a HEPA filter change, when dropped or damaged or moved from the project site. Only HEPA systems that pass the challenge DOP testing can be used on the project. All HEPA equipment shall be tested per ANSI/ASME N510 Section 10 to ensure 99.97% efficiency at 0.3 micrometer mean aerodynamic diameter.

2. The entire piece of HEPA equipment shall be challenge tested, not just the filter media. The University's Consultant or EH&S shall witness the HEPA challenge testing procedure in entirety. Once the HEPA system passes the challenge testing and passes, the HEPA equipment may be used at the location tested for a period not to exceed one year. The testing label shall remain on the HEPA equipment and remain legible. Re-testing of the HEPA equipment is required annually, if the piece of equipment is transported out of the building to another building location on the campus, if dropped, or otherwise subjected to forces that might unseat the HEPA filter, damaged by water or laceration of the filter or if HEPA filter maintenance or adjustments are performed.
3. When utilizing HEPA Filtered Vacuums for glove boxes or shrouded tools these HEPA Vacuums must be DOP tested.

### 3.04 NEGATIVE AIR MONITORING CRITERIA

#### A. Fully Monitored Negative Air Maintaining -0.020" Water Column (in-WC)

1. Build containment with negative air machines capable of maintaining a pressure differential of -0.020 in-WC across all critical barriers
2. Demonstrate negative pressure is achieved continuously (24/7) by means of an electronic manometer sensitive to measure down to -0.020" wp. The manometer shall be capable of measuring the water pressure down to at least -0.001" in-WC.
3. An Omniguard IV recording manometer is recommended as the standard instrument for containment pressure monitoring, but other electronic manufactured models with similar sensitivities at low pressures and recording capabilities are acceptable.
4. Inclined manometers using a liquid water solution and non-digital air pressure gauges are not an acceptable manometer since they do not meet the sensitivity of measuring -0.001" WC.
5. Zero pressure or positive pressure is unacceptable and must be responded to immediately. Locate and repair holes or breaches in exterior containment system with tape. Secure zip poles if they have fallen. Close entry door by zipping lower or closing flaps and securing.

#### B. Hybrid Monitoring and Visual Verification

1. Build containment with negative air machines capable of maintaining a pressure differential of -0.020 in-WC across all critical barriers.
2. During the course of construction, the scope of work may dictate removal of work (e.g. Ceilings or drywall) that would make it difficult to maintain -0.02 in-WC of negative pressure. During working hours Visual Verification of negative pressure may be used in lieu of the -0.02 in-WC requirement with electronic monitoring.
3. At the end of shift all openings must be sealed to bring the containment back to the -0.020 in-WC requirement.

## ADDITIONAL CONTAINMENT CRITERIA

### C. Ante Room

1. An ante room is a separate chamber attached to the containment area with zippered doors to allow entry and exit into the containment area. Entry into the containment area shall be only via the ante room. The ante room is commonly constructed of zip poles or equivalent, plastic and tape. The ante room is sized for each project to allow workers and equipment to be moved into and out of the containment area. A sticky mat is required in the ante room for workers and carts on wheels to use when exiting the ante room from the containment area. The zippered doors are to remain closed or adjusted slightly open as necessary to allow negative pressure to be maintained at a minimum of  $-0.020$  in-WC during work periods and during off hours.
2. The ante room shall have a sticky mat present which is intended to remove any debris from the bottom of work shoes before leaving the ante room into the public area. The sticky mat is not intended to clean debris from the bottom of disposable coveralls or from booties. The sticky mat layers shall be replaced many times during a work shift when work involves movement of many workers and supplies out of the containment area.
3. All people who enter and leave the project containment area including the contractor and all subcontractor employees are responsible for removing a dirty sticky mat and replacing it with a clean one when it is necessary. This includes all University Representatives, Consultants, Infection Prevention, Inspector of Record, Environmental Health & Safety, Engineers, Architects, etc.
4. People entering into the containment area will put on a full body disposable coverall with booties inside of the ante room before entering the containment area. Entry into the ante room requires one of the two zippered doors to be opened at one time to maintain the required negative pressure. After entering the ante room, the zipper shall be closed before leaving the ante room into the containment area.

### D. Air Scrubbing

1. The **Contractor** shall place additional HEPA filtered fan units (negative air unit) inside of the project work area and operate them in recirculation mode or "scrub mode" near the final cleaning phase of the project to aide in additional particulate cleaning of the space. These units will circulate air internal to the containment area and scrub the air to reduce the total airborne particle concentrations inside of the containment area.

### E. Disposable Coveralls and Booties

1. Disposable coveralls are required in all Class IV containment areas and selected to provide protection of street clothes from particulates generated inside of the containment area. Disposable coveralls shall be changed if they become ripped and are no longer serviceable. Disposable coveralls are required to protect the patients and are considered Patient Protective Apparel (PPA), since they are designed to protect patients who might be susceptible to the dust generating activity of the construction area.

2. Coveralls are not necessarily considered personal protective equipment (PPE), which is designed to protect the worker, unless the work activity involves asbestos, lead or other chemicals involved in the construction area.
3. Proper use of the disposable coveralls, booties and use of the sticky mat shall be followed at all times for all workers and UC Davis Health employees, when it is required by the ICRA Permit. At no time shall workers leave the containment area wearing disposable coveralls and booties. They are to be removed in the ante room or immediately in front of the ante room within the containment area if it is free and clean of debris. The workers shall remove all disposable coveralls and booties and place them in the plastic garbage bag and leave the ante room after walking on the sticky mat.

### 3.05 CONTAINMENT SET UP

- A. Notify University's Representative forty-eight (48) hours prior to containment set up.
- B. Build containment in compliance with ICRA, drawings and plans.
- C. Notify University's Representative and EH&S for inspection prior to start of work. Before any demolition or construction begins, all Protection Areas (infection control areas), control measures put in place and work plan by the **Contractor** will be inspected by the University's Environmental Health & Safety Personnel, or by a designated representative of the University. Work cannot begin until the containment area has been inspected and approved, meeting all of the provisions of the ICRA Permit.

### 3.06 REMOVAL OF CONTAINMENT

- A. Provide thorough cleaning of existing surfaces, which become exposed to dust, before leaving the containment area and before allowing staff and the public access to the project area.
- B. Final cleaning of the containment area requires diligent HEPA vacuuming of all horizontal surfaces and wet wiping all surfaces. Clean towels, sponges, cloth rags or other means shall be used with clean water to effectively clean all surfaces within the containment area. Use of a measured solution of an EPA Listed Germicide is required as part of the final detail cleaning. Use an appropriate attachment to ensure all large dust is removed. Vacuum slowly and pay special attention to cracks and crevices where dust may have accumulated.
- C. Prepare a measured solution of a University approved Environmental Protection Agency listed disinfectant and use according to the instructions on the label. Using clean towels or sponges, wipe all surfaces with the disinfectant. If visible dust accumulates on the applicator, wipe again until no residue is detected. Frequently change to clean applicators. Leave the surface wet and allow to air dry. Do not wipe dry.
- D. Remove the top floor layer, if present and HEPA vacuum and wipe down the bottom floor layer. The inspection will not be performed until the containment is dry.
- E. Additional HEPA filtered negative air units may be installed for scrubbing of particles (see 3.05 B).
- F. Coordinate with the University's Representative to call for a final visual inspection of the containment area. The final visual inspection will be made after the **Contractor** has thoroughly cleaned the entire containment area. The **Contractor** will be allowed to remove the containment barriers after the interior has passed the visual inspection for cleanliness.

- G. Particle count assessment may be made inside of the containment area by the University's Representative as part of the final visual inspection process in addition to the final visual inspection. Particle testing will include testing the airborne concentration of various particle sizes compared to the concentration outside of the containment area. If particle counts inside of the containment area are significantly greater than outside of the containment area, the **Contractor** shall continue to scrub the air inside of the project area with HEPA filtered negative air units and conduct additional surface cleaning until subsequent particle testing has demonstrated particle concentrations inside of the containment area are not significantly greater than particle concentrations immediately outside of the containment area.
- H. The University's Representative is required to provide a 24-hour notification to University Environmental Services that terminal cleaning will be needed, in addition to notification at the time the containment is being removed. Note that containment removal cannot take place until the Contractor has completed a full cleaning of the containment and the final visual inspection has passed.

#### ENTRY/EGRESS

- I. Entry into the project containment area shall be through the ante room. Entry into the ante room requires one of the two zippered doors to be opened at one time to maintain the required negative pressure. After entering the ante room, the zipper shall be closed before leaving the ante room into the containment area. Equipment and supplies brought into the containment area shall be in sealed leak tight containers inside of rolling covered carts. Equipment, tools and supplies brought into the building shall be clean and free of dust, debris, mold and other contaminants. Cardboard products shall not be brought into the containment area if they are water damaged or have suspect mold growth.
- J. All HEPA equipment when transported into and out of the containment area shall be cleaned of all debris on the surfaces and shall have the intake openings sealed with plastic and duct tape.
- K. All workers leaving the containment area shall leave in clean clothes. At no time shall disposable coveralls or booties be worn when leaving the containment area through the anteroom into the public area. The workers shall clean all gross particulate debris from the coveralls using a HEPA filtered vacuum. Disposable coveralls can be taken off after gross debris has been removed from the disposable coveralls. The worker shall remove the disposable coverall inside of the ante room by rolling the disposable coverall inside out and then place it into a garbage container (plastic bag) located inside of the ante room or just inside of the project work area.
- L. All equipment and supplies leaving the containment area shall be cleaned of all dust and debris before leaving the containment area. Removal of supplies, materials and waste debris from the containment area shall be using tightly covered containers/carts that contain the waste material. The wheels of carts shall be cleaned on a frequent schedule to minimize track-out of debris as they are removed from the containment area. All waste material shall be in sealed leak tight containers. If plastic bags are used, they shall be 6 mil thick at a minimum.



3.07 ENFORCEMENT

- A. Failure to maintain required containment will result in issuance of written warning; if situation is not corrected within eight (8) hours of receipt of warning, University will have cause to stop the work as provided in Article 2.1 (if Brief Form) or 2.3 (if Long Form) of the General Conditions. Any egregious violation of safety requirements shall be grounds for Immediate Work Stoppage.

3.08 Refer to the following Attachments

- A. Infection Control Risk Assessment (ICRA) with Matrix of Precautions for Construction & Renovation: 3 Pages.
- B. Infection Control Construction Permit: 1 Page.
- C. UCDH Construction Dust & Hazardous Materials Inspection Worksheet: 1 Page.
- D. ICRA Permit Extension Request and Instructions: 2 Pages.

UC Davis Health Construction Dust Infection Prevention Best Practice Standard: 23 Pages including.

1. Appendix A: Inspection Documentation Form and Daily Inspection Log.
2. Appendix B: Entry Warning Sign with Project Manager Contact.
3. Appendix C: Staff Education Poster.

**END OF SECTION 015610**

| BASIC PROJECT INFORMATION          |                           |                            |             |
|------------------------------------|---------------------------|----------------------------|-------------|
| Project Name:                      | Project Number:           | Today's Date               |             |
| Impacted Department(s):            | Building Number and Name: | Floor:                     | Suite/Room: |
| Estimated Construction Start Date: |                           | Estimated Completion Date: |             |
| UCDH Project Manager:              | UCDH PM Mobile Phone #:   | UCDH PM Email:             |             |
| Construction Manager:              | CM Mobile Phone:          | CM Mobile Email:           |             |

| GENERAL PROJECT SCOPE |
|-----------------------|
|                       |

**ATTACH DESCRIPTIVE PROJECT SCHEMATIC OR IMAGE TO PACKET**

**MULTIDISCIPLINARY TEAM**

Identify the multidisciplinary team that was included in the review of this packet and agree with the requirements identified within the packet.

| Department                           | Name | Email |
|--------------------------------------|------|-------|
| UCDH Project Manager                 |      |       |
| Fire Marshal's Office                |      |       |
| Infection Prevention                 |      |       |
| Environmental Health & Safety        |      |       |
| Contractor Representative            |      |       |
| Other Multidisciplinary Team Members |      |       |

# INFECTION CONTROL RISK ASSESSMENT

**Step One:** Using the table, identify the Construction Project Activity Type (A-E).

|   |   |
|---|---|
| <b>Type A</b><br><input type="checkbox"/> | <p><b>Inspection and non-invasive activities.</b><br/>Includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Removal of ceiling tile for visual inspection-limited to 1 tile per 50 square feet with limited exposure time.</li> <li>• Limited building system maintenance (e.g., pneumatic tube station, HVAC system, fire suppression system, electrical and carpentry work to include painting without sanding) that does not create dust or debris.</li> <li>• Clean plumbing activity limited in nature.</li> </ul>  |
| <b>Type B</b><br><input type="checkbox"/> | <p><b>Small-scale, short duration activities that create minimal dust and debris.</b><br/>Includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Work conducted above the ceiling (e.g., prolonged inspection or repair of firewalls and barriers, installation of conduit and/or cabling, and access to mechanical and/or electrical chase spaces).</li> <li>• Fan shutdown/startup.</li> <li>• Installation of electrical devices or new flooring that produces minimal dust and debris.</li> <li>• The removal of drywall where minimal dust and debris is created.</li> <li>• Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris.</li> </ul>   |
| <b>Type C</b><br><input type="checkbox"/> | <p><b>Large-scale, longer duration activities that create a moderate amount of dust and debris.</b><br/>Includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Removal of preexisting floor covering, walls, casework or other building components.</li> <li>• New drywall placement.</li> <li>• Renovation work in a single room.</li> <li>• Nonexistent cable pathway or invasive electrical work above ceilings.</li> <li>• The removal of drywall where a moderate amount of dust and debris is created.</li> <li>• Dry sanding where a moderate amount of dust and debris is created.</li> <li>• Work creating significant vibration and/or noise.</li> <li>• Any activity that cannot be completed in a single work shift.</li> </ul> |
| <b>Type D</b><br><input type="checkbox"/> | <p><b>Major demolition and construction activities.</b><br/>Includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Removal or replacement of building system component(s).</li> <li>• Removal/installation of drywall partitions.</li> <li>• Invasive large-scale new building construction.</li> <li>• Renovation work in two or more rooms.</li> </ul>  |
| <b>Type E</b><br><input type="checkbox"/> | <p><b>Exterior Construction typical activities.</b><br/>include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Excavation, Trenching, Grading, Boring, Pile Driving, Demolition</li> <li>• Asphalt, Concrete, Stucco, Scaffolding</li> <li>• Roofing</li> <li>• Window washing, Caulking, Tuckpointing, Cleaning, Painting</li> <li>• Landscaping, Planting</li> </ul>   |

**Explain this Reasoning for this Assessment:**

**Step Two: Using the table below, identify the Patient Risk Group(s) that will be affected. If more than one risk group will be affected, select the higher risk group.**

| Low Risk<br>Non-patient care areas<br>such as:  | Medium Risk<br>Patient care support<br>areas such as:  | High Risk<br>Patient care areas such<br>as:  | Highest Risk<br>Procedural, invasive, sterile<br>support and highly compromised<br>patient care areas such as:   |
|---|--|--|--|
| <input type="checkbox"/> Office areas not on clinical units<br><input type="checkbox"/> Breakrooms not on clinical units<br><input type="checkbox"/> Bathrooms or locker rooms not on clinical units<br><input type="checkbox"/> Mechanical rooms not on clinical units<br><input type="checkbox"/> EVS closets not on clinical units<br><input type="checkbox"/> Corridors and gathering areas not near clinical units | <input type="checkbox"/> Waiting / Lobby areas<br><input type="checkbox"/> Clinical engineering<br><input type="checkbox"/> Materials management<br><input type="checkbox"/> Sterile processing department - dirty side<br><input type="checkbox"/> Cafeteria, gift shop, coffee shop, and food kiosks<br><input type="checkbox"/> Public hallways and gathering areas near clinical units | <input type="checkbox"/> Patient care rooms and areas<br><input type="checkbox"/> All acute care units<br><input type="checkbox"/> Emergency department<br><input type="checkbox"/> Employee health<br><input type="checkbox"/> Pharmacy: General Work Zone<br><input type="checkbox"/> Medication rooms and clean utility rooms<br><input type="checkbox"/> Imaging suites: diagnostic imaging<br><input type="checkbox"/> Laboratory<br><input type="checkbox"/> Kitchen | <input type="checkbox"/> All transplant and intensive care units<br><input type="checkbox"/> All oncology units and other areas with severely immunocompromised patients<br><input type="checkbox"/> OR theaters and restricted areas<br><input type="checkbox"/> Procedural suites<br><input type="checkbox"/> Pharmacy compounding<br><input type="checkbox"/> Sterile processing department: Clean side<br><input type="checkbox"/> Transfusion services<br><input type="checkbox"/> Dedicated isolation units and isolation rooms<br><input type="checkbox"/> Imaging suites: invasive imaging<br><input type="checkbox"/> Dialysis unit |
| <b>Describe key patient risks:</b>  |  |  |  |

**Step Three: Match the Patient Risk Group (Low, Medium, High, Highest) from Step Two with the planned Construction Activity Project Type (A, B, C, D, E) from Step One using the table below to find the Class of Precautions (I, II, III, IV or V) or level of infection control activities required. The activities are listed in the table below – Minimum Required Infection Control Precautions by Class.**

| Patient Risk Group | Construction Project Activity Type |                              |                               |                               |                                   |
|--------------------|------------------------------------|------------------------------|-------------------------------|-------------------------------|-----------------------------------|
|                    | TYPE A                             | TYPE B                       | TYPE C                        | TYPE D                        | TYPE E                            |
| LOW Risk           | <input type="checkbox"/> I         | <input type="checkbox"/> II  | <input type="checkbox"/> II   | <input type="checkbox"/> III* | <input type="checkbox"/> Exterior |
| MEDIUM Risk        | <input type="checkbox"/> I         | <input type="checkbox"/> II  | <input type="checkbox"/> III* | <input type="checkbox"/> IV   |                                   |
| HIGH Risk          | <input type="checkbox"/> I         | <input type="checkbox"/> III | <input type="checkbox"/> IV   | <input type="checkbox"/> V    |                                   |
| HIGHEST Risk       | <input type="checkbox"/> III       | <input type="checkbox"/> IV  | <input type="checkbox"/> V    | <input type="checkbox"/> V    |                                   |

All construction and maintenance activities as defined in Step 1 require a permit and approval unless the work does not expose patients or employees and the ICRA Committee determines there is no appreciable risk to patients for acquired infection due to the project. Such decisions must be documented.

Environmental conditions that could affect human health, such as sewage, Mold, asbestos, gray water, and black water will require Class of Precautions IV for LOW and MEDIUM Risk Groups and Class of Precautions V for HIGH and HIGHEST Risk Groups.

Class III\* Precautions - Type C [Medium Risk groups] and Type D [Low Risk Groups] work areas that cannot be sealed and completely isolated from occupied patient care spaces should be elevated to include negative air exhaust requirements as listed in Class IV Precautions.

## Surrounding Area Assessment

Step Four: Assess potential risk to areas surrounding the project. Using the table below, identify the surrounding areas that will be affected and the type of impact that will occur. If more than one risk group is impacted, select the higher risk group using Step 2 - Patient Risk Group.

| Unit Location:                    | Below  | Above  | Lateral  | Behind   | Front  |
|-----------------------------------|--|--|--|--|--|
| Unit Name:                        |  |  |  |  |  |
| Risk Group:                       |  |  |  |  |  |
| Unit Contact:                     |  |  |  |  |  |
| Phone:                            |  |  |  |  |  |
| Email:                            |  |  |  |  |  |
| Additional Controls:              | <input type="checkbox"/> Noise<br><input type="checkbox"/> Vibration<br><input type="checkbox"/> Dust control<br><input type="checkbox"/> Ventilation<br><input type="checkbox"/> Pressurization | <input type="checkbox"/> Noise<br><input type="checkbox"/> Vibration<br><input type="checkbox"/> Dust control<br><input type="checkbox"/> Ventilation<br><input type="checkbox"/> Pressurization | <input type="checkbox"/> Noise<br><input type="checkbox"/> Vibration<br><input type="checkbox"/> Dust control<br><input type="checkbox"/> Ventilation<br><input type="checkbox"/> Pressurization | <input type="checkbox"/> Noise<br><input type="checkbox"/> Vibration<br><input type="checkbox"/> Dust control<br><input type="checkbox"/> Ventilation<br><input type="checkbox"/> Pressurization | <input type="checkbox"/> Noise<br><input type="checkbox"/> Vibration<br><input type="checkbox"/> Dust control<br><input type="checkbox"/> Ventilation<br><input type="checkbox"/> Pressurization |
| Impact on other systems, such as: | <input type="checkbox"/> Data<br><input type="checkbox"/> Mechanical<br><input type="checkbox"/> Med Gases<br><input type="checkbox"/> Water Systems   | <input type="checkbox"/> Data<br><input type="checkbox"/> Mechanical<br><input type="checkbox"/> Med Gases<br><input type="checkbox"/> Water Systems   | <input type="checkbox"/> Data<br><input type="checkbox"/> Mechanical<br><input type="checkbox"/> Med Gases<br><input type="checkbox"/> Water Systems   | <input type="checkbox"/> Data<br><input type="checkbox"/> Mechanical<br><input type="checkbox"/> Med Gases<br><input type="checkbox"/> Water Systems   | <input type="checkbox"/> Data<br><input type="checkbox"/> Mechanical<br><input type="checkbox"/> Med Gases<br><input type="checkbox"/> Water Systems   |
| Notes:                            |  |  |  |  |  |

Were there discoveries in surrounding areas that would serve as cause to increase the class of precautions and necessitate additional controls? If so, please summarize.

# NOISE AND VIBRATION ASSESSMENT

| Type   | Suggested Control Measures   |
|--|--|
| <input type="checkbox"/> Drilling<br><input type="checkbox"/> Heavy Equipment<br><input type="checkbox"/> Motors<br><input type="checkbox"/> Pounding<br><input type="checkbox"/> Grinding<br><input type="checkbox"/> Other: Click or tap here to enter text. | <input type="checkbox"/> <b>Required for high-impact activities</b> – Notify PO&M, Building Coordinator and EH&S<br><input type="checkbox"/> Always consider using Engineering solutions before using Personal Protective Equipment.<br><input type="checkbox"/> Coordinate disruption plan with PO&M and other stakeholders as necessary<br><input type="checkbox"/> Deploy noise dampening blankets or other similar equipment<br><input type="checkbox"/> Use tools or alternative methods designed to minimize noise and vibrations <ul style="list-style-type: none"> <li><input type="checkbox"/> Use diamond drills instead of powder-actuated fasteners</li> <li><input type="checkbox"/> Use beam clamps instead of shot</li> <li><input type="checkbox"/> Prefab where possible</li> <li><input type="checkbox"/> Use tin snips to cut metal studs instead of using a chop saw</li> <li><input type="checkbox"/> Install metal decking with vent tabs, then use cellular floor deck hangers</li> <li><input type="checkbox"/> Consider pro-press instead of soldering, brazing, or welding</li> <li><input type="checkbox"/> Wet core drill instead of dry core or percussion</li> <li><input type="checkbox"/> Instead of jackhammering concrete, use wet diamond saws</li> <li><input type="checkbox"/> Use HEPA vacuums instead of standard wet/dry vacuums</li> <li><input type="checkbox"/> Use mechanical joining system sprinkler fittings instead of threaded</li> <li><input type="checkbox"/> Where fumes are tolerated, use chemical adhesive remover instead of mechanical</li> <li><input type="checkbox"/> To remove flooring, shot blast instead of using a floor scraper</li> <li><input type="checkbox"/> Use electric sheers instead of reciprocating saw for ductwork cutting.</li> <li><input type="checkbox"/> Install exterior man/material lifts.</li> </ul> <input type="checkbox"/> Provide staff and/or patients with noise-reducing protective equipment (e.g., ear plugs)<br><input type="checkbox"/> Relocate members/staff to another area of the facility for the duration of the activity<br><input type="checkbox"/> Notify affected areas before noise or vibration-producing activity<br><input type="checkbox"/> Schedule activities during hours that minimize patient, visitor, and staff impact.<br>Hours: Click or tap here to enter text.<br><input type="checkbox"/> Other: Click or tap here to enter text. |

# AIR QUALITY IMPACT

| Type  | Suggested Control Measures   |
|---|--|
| <input type="checkbox"/> Dust<br><input type="checkbox"/> Chemical (VOC)<br><input type="checkbox"/> Fugitive Emissions (Fumes)<br><input type="checkbox"/> Potential Mold<br><small>Note: If Mold is encountered, follow work practices outlined in the General Requirements Division 1 Section 01561 Document.</small><br><input type="checkbox"/> Asbestos<br><input type="checkbox"/> Paint Solvent/Cleaner<br><input type="checkbox"/> Roofing Tar<br><input type="checkbox"/> Other: Click or tap here to enter text. | <input type="checkbox"/> Restrict/shut down air handlers for the duration of activity<br><input type="checkbox"/> Install temporary partitions<br><input type="checkbox"/> Install charcoal filters in HVAC or portable units<br><input type="checkbox"/> Install temporary ductwork and portable units<br><input type="checkbox"/> Prohibit idling of heavy equipment engines<br><input type="checkbox"/> Provide local exhaust ventilation<br><input type="checkbox"/> Substitute material with low VOC product<br><input type="checkbox"/> Notify area staff and EH&S before construction activity that may impact air quality<br><input type="checkbox"/> Provide negative pressure/HEPA filtration<br><input type="checkbox"/> Exhaust HEPA–99.97% to exterior<br><input type="checkbox"/> Relocate members/staff to another area of the facility for the duration of the activity<br><input type="checkbox"/> Schedule activities during hours that minimize patient, visitor, and staff impact.<br>Hours: Click or tap here to enter text.<br><input type="checkbox"/> Provide Safety Data Sheets to EH&S for other recommended actions<br><input type="checkbox"/> Other: Click or tap here to enter text. |

# HAZARDOUS MATERIALS

A determination regarding the presence of hazardous materials in all UCDH buildings must be made before a project starts. This can be accomplished by existing surveys that identify the presence of hazardous materials or by hiring a consultant to perform a hazardous materials assessment of the areas that the project will impact. All impacted Hazardous Materials must be handled per the appropriate control measures.

Note: A Certified Asbestos Consultant must have conducted an asbestos survey before any demolition or renovation activity. There are no exceptions based on the date of construction or the facility's age.

## ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS

|   |   |   |                             |
|---|---|---|-----------------------------|
| Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)?   |   | <input type="checkbox"/> Yes                | <input type="checkbox"/> No |
| How was this verified?  | <input type="checkbox"/> Hazmat Survey  | <input type="checkbox"/> Personal Knowledge |                             |
|   | <input type="checkbox"/> Other:   |   |                             |
| Who verified this information?  | <input type="checkbox"/> Company:   |   |                             |
|   | <input type="checkbox"/> Person and Department:                                 |   |                             |
|   | <input type="checkbox"/> Other:   |   |                             |
| <b>Hazardous Materials Present in Project Work Area</b>   | <b>Required Control Measures</b>  |   |                             |
| <input type="checkbox"/> Asbestos<br><input type="checkbox"/> Lead<br><input type="checkbox"/> PCBs<br><input type="checkbox"/> Universal Waste<br><input type="checkbox"/> Other: <a href="#">Click or tap here to enter text.</a> | Follow work practices outlined in the General Requirements Division 1 Document. |   |                             |



## CONTAINMENT REQUIREMENTS WORKSHEET

|   |   |  |  |
|---|---|--|--|
| <b>Containment Barrier</b>  | <b>Where construction will impact fire-rated assemblies, the contractor is responsible for constructing interim assemblies and barriers that maintain the integrity of the structure's fire-rated system. Note: Interim Life Safety Measures may be required.</b> |  |  |
|   | <input type="checkbox"/> Full Containment (poly over all surfaces within containment)   |  |  |
|   | <input type="checkbox"/> The ceiling plenum within the work area shall be isolated and sealed by fire-rated six mil. poly   |  |  |
|   | <input type="checkbox"/> Hard Barriers are recommended for work lasting greater than 30 days and in high-traffic areas.   |  |  |
|   | <input type="checkbox"/> Fire retardant plastic barriers are recommended for work lasting less than 30 days. Plastic Barriers cannot be used where hot work will be performed.  |  |  |
|   | <input type="checkbox"/> Isolated Room – Critical Openings Only (seal doors, supply and return registers, etc.)   |  |  |
|   | <input type="checkbox"/> Prefabricated Containment Cube (only large enough for 1-2 people; aka pop-up cube or Mini Cube)  |  |  |
|   | <input type="checkbox"/> Shrouded Tool with HEPA filtered exhaust   |  |  |
| <input type="checkbox"/> Glove Box Containment with HEPA filtered exhaust                               |   |  |  |
| <input type="checkbox"/> Other:   |   |  |  |
| <b>Negative Pressure</b>  | The contractor is required to maintain and document negative air pressure. DOP Tested HEPA-filtered negative air machines (with a minimum of 99.97% efficiency) and a rating of 200 to 2000 cubic feet per minute (CFM) is required for construction activities.  |  |  |
|   | <input type="checkbox"/> -0.020" WC always displayed on a mounted digital manometer   |  |  |
|   | <input type="checkbox"/> -0.020" WC at setup with negative pressure throughout the project as displayed on the manometer  |  |  |
|   | <input type="checkbox"/> Visual Verification of some negative room pressure throughout the project  |  |  |
|   | <input type="checkbox"/> No negative room pressure required   |  |  |
|   | <input type="checkbox"/> Negative pressure in localized HEPA exhausted work area (e.g., shrouded tool, glove box)   |  |  |
|   | <input type="checkbox"/> Additional Ante room under negative pressure   |  |  |
| <input type="checkbox"/> Other:   |   |  |  |
| <b>Air Exhaust</b>  | <input type="checkbox"/> Air exhausted directly outside - Avoid exhausting air near air intakes or operable windows doors, and avoid exhausting air near walkways   |  |  |
|   | <input type="checkbox"/> For air exhausted inside, check any of the following conditions that are required:   |  |  |
|   | <input type="checkbox"/> Additional Filtration (ex. Charcoal, Diffuser system)  |  |  |
|   | <input type="checkbox"/> Exhaust into Ducts/HVAC system – Mechanical engineer must confirm that exhausted air will not negatively impact the air balance of the existing system   |  |  |
|   | <input type="checkbox"/> Onsite Challenge Testing (DOP or particle counting) before containment setup   |  |  |
| <input type="checkbox"/> Challenge Tested within last six months; Equipment has remained onsite at UCDH |   |  |  |
| <b>Additional Containment Requirements</b>  | <input type="checkbox"/> Ante Room  | <input type="checkbox"/> Masonite Floor Protection   | <input type="checkbox"/> Protective Clothing         |
|   | <input type="checkbox"/> Walk Off Mats  | <input type="checkbox"/> Shoe Covers   | <input type="checkbox"/> Collect Samples During Work |
|   | <input type="checkbox"/> Other:   |  |  |
| <b>Verification of Work</b>   | <input type="checkbox"/> HEPA Equipment Verification  | <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> Other:  |  |
|   | <input type="checkbox"/> Pre-Work Approval Inspection   | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |  |
|   | <input type="checkbox"/> Daily Onsite Oversight   | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |  |
|   | <input type="checkbox"/> Post Demolition/Abatement Inspection   | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |  |
|   | <input type="checkbox"/> ICRA Downgrade   | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |  |
|   | <input type="checkbox"/> Final Visual Containment Inspection  | <input type="checkbox"/> PM <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> IOR <input type="checkbox"/> Other: |  |
|   | <input type="checkbox"/> Air Sampling   | <input type="checkbox"/> EH&S <input type="checkbox"/> Consultant <input type="checkbox"/> Other:  |  |
| <b>Air Sampling</b>   | <input type="checkbox"/> Particle Counting <input type="checkbox"/> Mold <input type="checkbox"/> Asbestos <input type="checkbox"/> Other:  |  | Frequency:   |
| <b>Air Balance in Adjacent Areas:</b>   | The contractor is responsible for maintaining air balance in adjacent <u>high</u> and <u>highest-risk</u> areas per design/ASHRAE guidelines. Contact PO&M to verify the air balance requirements of surrounding areas.   |  |  |
|   | <b>Adjacent High/Highest Risk Areas</b>   |  | <b>Air Balance Requirements</b>                      |
|   |   |  | Positive/negative pulldown                           |

|                           |  |                            |
|---------------------------|--|----------------------------|
|                           |  | Positive/negative pulldown |
| <b>ICRA Permit Number</b> |  | <b>ICRA Class</b>          |
| <b>23-00001</b>           |  | Choose an item.            |

|   |                                  |                                     |             |
|---|----------------------------------|-------------------------------------|-------------|
| Project Number:                               |                                  | Project Name:                       |             |
| Impacted Department:                          | Building Number and Name:        | Floor:                              | Suite/Room: |
| UCDH Project Manager:                         | UCDH PM Mobile Phone #:          | UCDH PM Email:                      |             |
| Construction Manager:                         | CM Mobile Phone:                 | CM Mobile Email:                    |             |
| General Contractor:                           | General Contractor Mobile Phone: | General Contractor Mobile Email:    |             |
| Containment will be set up and maintained by: |                                  | Third-Party Containment Consultant: |             |

|   |                 |                           |                                  |
|---|-----------------|---------------------------|----------------------------------|
| <b>ICRA Class</b> Choose an item.                     |                 | <b>Project Start Date</b> | <b>Completion Date</b>           |
| <b>Additional Requirements</b>                        |                 |                           |                                  |
| <b>Signatures</b>                                     | Project Manager | General Contractor        | Infection Control and Prevention |
| <b>Downgrade Request – ICRA Class</b> Choose an item. |                 | <b>Project Start Date</b> | <b>Completion Date</b>           |
| <b>Additional Requirements</b>                        |                 |                           |                                  |
| <b>Signatures</b>                                     | Project Manager | General Contractor        | Infection Control and Prevention |
| <b>Extension Request – ICRA Class</b> Choose an item. |                 | <b>Project Start Date</b> | <b>Completion Date</b>           |
| <b>Additional Requirements</b>                        |                 |                           |                                  |
| <b>Signatures</b>                                     | Project Manager | General Contractor        | Infection Control and Prevention |

## INFECTION PREVENTION REQUIREMENTS - CLASS I

|  |   |
|--|---|
| <b>Prior to and During Construction:</b> | <ul style="list-style-type: none"> <li>• Perform noninvasive work activity as to not block or interrupt patient care.</li> <li>• Perform noninvasive work activities in areas that are not directly occupied with patients.</li> <li>• Perform noninvasive work activity in a manner that does not create dust.</li> <li>• Immediately replace any displaced ceiling tile before leaving the area and/or at end of noninvasive work activity.</li> </ul>  |
| <b>Upon Completion of Work:</b>          | <p>Cleaning</p> <ul style="list-style-type: none"> <li>• Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.</li> <li>• Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.</li> </ul> <p>HVAC Systems</p> <ul style="list-style-type: none"> <li>• Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational.</li> <li>• Verify the HVAC systems meet original airflow and air exchange design specifications.</li> </ul> |
|  | <p>Additional Infection Prevention Requirements:</p>  |

## INFECTION PREVENTION REQUIREMENTS - CLASS II

|  |  |
|--|--|
| <b>Prior to and During Construction:</b> | <ul style="list-style-type: none"> <li>• Perform only limited dust work and/or activities designed for basic facilities and engineering work.</li> <li>• Perform limited dust and invasive work following standing precautions procedures approved by the organization.</li> <li>• This Class of Precautions must never be used for construction or renovation activities.</li> </ul>  |
| <b>Upon Completion of Work:</b>          | <p>Cleaning:</p> <ul style="list-style-type: none"> <li>• Clean work areas including all environmental surfaces, high horizontal surfaces, and flooring materials.</li> <li>• Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.</li> </ul> <p>HVAC Systems:</p> <ul style="list-style-type: none"> <li>• Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational.</li> <li>• Verify the HVAC systems meet original airflow and air exchange design specifications.</li> </ul> |
|  | <p>Additional Infection Prevention Requirements:</p>   |

## INFECTION PREVENTION REQUIREMENTS - CLASS III

|                                   |   |
|-----------------------------------|---|
| Prior to and During Construction: | <ul style="list-style-type: none"> <li>• Provide active means to prevent airborne dust dispersion into the occupied areas.</li> <li>• Means for controlling minimal dust dispersion may include hand-held HEPA vacuum devices, polyethylene plastic containment, or isolation of work area by closing room door.</li> <li>• Remove or isolate return air diffusers to avoid dust from entering the HVAC system.</li> <li>• Remove or isolate the supply air diffusers to avoid positive pressurization of the space,</li> <li>• If work area is contained, then it must be neutrally to negatively pressurized at all times. *If negative pressure is required, see additional requirements below.</li> <li>• Seal all doors with tape that will not leave residue</li> <li>• Contain all trash and debris in the work area.</li> <li>• Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area.</li> <li>• Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled.</li> <li>• Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces.</li> </ul> <p><b>Additional requirements for Class III containments that require negative pressure:</b></p> <ul style="list-style-type: none"> <li>• Maintain negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows requires the highest degree of filtration feasible.</li> <li>• If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, HEPA filtration must be verified by particulate measurement as no less than 99.97% efficiency and must not alter or change airflow/pressure relationships in other areas.</li> <li>• Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable.</li> <li>• Install digital monitoring manometer with one thousandth of inch of water pressure (eg. - 0.024) exterior of work containment to continually monitor negative pressurization. The non-digital manometer monitors are not acceptable.</li> </ul> |
| Upon Completion of Work:          | <p>Cleaning:</p> <ul style="list-style-type: none"> <li>• Clean work areas including all environmental surfaces, high horizontal surfaces, and flooring materials.</li> <li>• Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.</li> </ul> <p>HVAC Systems:</p> <ul style="list-style-type: none"> <li>• Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational.</li> <li>• Verify the HVAC systems meet original airflow and air exchange design specifications.</li> </ul> <p><b>Class III precautions require inspection and documentation for downgraded ICRA precautions.</b></p> <p>Construction areas must be inspected by the designee on the containment requirements worksheet for discontinuation or downgrading of ICRA precautions.</p> <p>Work Area Cleaning:</p>   |

- Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.
- Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.

Removal of Critical Barriers:

- Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed.
- All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers:
  - Carefully remove screws and painter tape.
  - If dust will be generated during screw removal, use hand-held HEPA vacuum.
  - Drywall cutting is prohibited during removal process.
  - Clean all stud tracks with HEPA vacuum before removing outer hard barrier.
  - Use a plastic barrier to enclose area if dust could be generated.

Negative Air Requirements:

- The use of negative air must be designed to remove contaminants from the work area.
- Negative air devices must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers.

HVAC systems:

- Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed.
- Verify that HVAC systems are clean and operational.
- Verify the HVAC systems meets original airflow and air exchange design specifications.

Additional Infection Prevention Requirements:

## INFECTION PREVENTION REQUIREMENTS - CLASS IV

Prior to and During Construction:

- Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above.
- All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to ground and ceiling and secure from movement or damage. Apply tape that will not leave a residue to seal gaps between barriers, ceiling or floor.
- Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type).
- Containment units or environmental containment units (ECUs) approved for Class IV precautions in small areas totally contained by the unit and that has HEPA-filtered exhaust air (MiniCube Mobile Containments).
- Remove or isolate return air diffusers to avoid dust entering the HVAC system.
- Remove or isolate the supply air diffusers to avoid positive pressurization of the space.
- Negative airflow pattern must be maintained from the entry point to the anteroom and into the construction area. The airflow must cascade from outside to inside the construction area. The entire construction area must remain negatively pressurized.
- Maintain negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows requires the highest degree of filtration feasible.
- If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, HEPA filtration must be verified by particulate measurement as no less than 99.97% efficiency and must not alter or change airflow/pressure relationships in other areas.
- Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable.
- Install digital monitoring manometer with one thousandth of inch of water pressure (eg. - 0.024) exterior of work containment to continually monitor negative pressurization. The non-digital manometer monitors are not acceptable.
- Contain all trash and debris in the work area.
- Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area.
- Worker clothing must be clean and free of visible dust before leaving the work area. HEPA vacuuming of clothing or use of cover suites is acceptable.
- Workers must wear shoe covers prior to entry into the work area. Shoe covers must be changed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be immediately changed.
- Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled.
- Collection of particulate data during work may be collected to assure that contaminants do not enter the occupied spaces. Routine collection of particulate samples may be used to verify HEPA filtration efficiencies. Collection of particulate data may be collected by Environmental Health and Safety or approved third party consultant.

**Class IV precautions require inspection and documentation for downgraded ICRA precautions.**

Construction areas must be inspected by the designee on the containment requirements worksheet for discontinuation or downgrading of ICRA precautions.

**Work Area Cleaning:**

- Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.
- Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.

**Removal of Critical Barriers:**

- Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed.
- All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers:
  - Carefully remove screws and painter tape.
  - If dust will be generated during screw removal, use hand-held HEPA vacuum.
  - Drywall cutting is prohibited during removal process.
  - Clean all stud tracks with HEPA vacuum before removing outer hard barrier.
  - Use a plastic barrier to enclose area if dust could be generated.

**Negative Air Requirements:**

- The use of negative air must be designed to remove contaminants from the work area.
- Negative air devices must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers.

**HVAC systems:**

- Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed.
- Verify that HVAC systems are clean and operational.
- Verify the HVAC systems meets original airflow and air exchange design specifications.

**Additional Infection Prevention Requirements:**



# INFECTION PREVENTION REQUIREMENTS - CLASS V

Prior to and During Construction:

- Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above.
- All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to ground and ceiling and secure from movement or damage. Apply tape that will not leave a residue to seal gaps between barriers, ceiling or floor.
- Seal all penetrations in containment barriers, anteroom barriers, including floors and ceiling using approved materials (UL schedule firestop if applicable for barrier type).
- Construct anteroom large enough for equipment staging, cart cleaning, workers. The anteroom must be constructed adjacent to entrance of construction work area.
- Personnel will be required to wear coveralls at all times during Class V work activities. Coveralls must be removed before leaving the anteroom.
- Remove or isolate return air diffusers to avoid dust entering the HVAC system.
- Remove or isolate the supply air diffusers to avoid positive pressurization of the space.
- Negative airflow pattern must be maintained from the entry point to the anteroom and into the construction area. The airflow must cascade from outside to inside the construction area. The entire construction area must remain negatively pressurized.
- Maintain negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows requires the highest degree of filtration feasible
- If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, HEPA filtration must be verified by particulate measurement as no less than 99.97% efficiency and must not alter or change airflow/pressure relationships in other areas.
- Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (bathroom exhaust) is not acceptable.
- Install digital monitoring manometer with one thousandth of inch of water pressure (eg. -0.024) exterior of work containment to continually monitor negative pressurization. The non-digital manometer monitors are not acceptable.
- Contain all trash and debris in the work area.
- Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area.
- Worker clothing must be clean and free of visible dust before leaving the work area anteroom.
- Workers must wear shoe covers prior to entry into the work area. Shoe covers must be changed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be immediately changed.
- Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled.
- Collection of particulate data during work may be collected to assure that contaminants do not enter the occupied spaces. Routine collection of particulate samples may be used to verify HEPA filtration efficiencies. Collection of particulate data may be collected by Environmental Health and Safety or approved third party consultant.

**Class IV precautions require inspection and documentation for downgraded ICRA precautions.**

Construction areas must be inspected by the designee on the containment requirements worksheet for discontinuation or downgrading of ICRA precautions.

**Work Area Cleaning:**

- Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.
- Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.

**Removal of Critical Barriers:**

- Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed.
- All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers:
  - Carefully remove screws and painter tape.
  - If dust will be generated during screw removal, use hand-held HEPA vacuum.
  - Drywall cutting is prohibited during removal process.
  - Clean all stud tracks with HEPA vacuum before removing outer hard barrier.
  - Use a plastic barrier to enclose area if dust could be generated.

**Negative Air Requirements:**

- The use of negative air must be designed to remove contaminants from the work area.
- Negative air devices must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers.

**HVAC systems:**

- Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed.
- Verify that HVAC systems are clean and operational.
- Verify the HVAC systems meets original airflow and air exchange design specifications.

**Additional Infection Prevention Requirements:**

## INFECTION PREVENTION REQUIREMENTS – EXTERIOR

|  |   |
|--|---|
| <b>Prior to and During Construction:</b> | <ul style="list-style-type: none"> <li>• Identify and confirm fugitive fume and dust control measures are in place prior to work starting i.e., charcoal filters at air intakes, scrubbers on equipment etc.</li> <li>• Contractor must submit an excavation and trenching plan for review and implementation.</li> <li>• Install fencing, physical barriers and interior/exterior signage to re-direct pedestrian and vehicular traffic as necessary.</li> <li>• If locally required, validate soil survey was performed to identify potential contaminants (e.g., valley fever, radon, legionellosis, etc.).</li> <li>• Ensure that fugitive dust control measures are adhered to (e.g., work area is kept wet).</li> <li>• Validate those fumes created by equipment and material is controlled.             <ul style="list-style-type: none"> <li>o If required, install charcoal filters on air intake to building.</li> <li>o Maintain equipment exhaust scrubbers if working near sensitive areas or near air-intake</li> <li>o Minimize equipment idling</li> </ul> </li> <li>• Validate barriers restricting access and signage into construction work areas are maintained.</li> </ul> |
| <b>Upon Completion of Work:</b>          | <ul style="list-style-type: none"> <li>• Ensure all control measures are removed at completion of project.</li> </ul>   |
|  | Additional Infection Prevention Requirements:   |

## SECTION 01 56 20

### REQUIREMENTS FOR CEILING ACCESS TO SPACES CONTAINING ASBESTOS

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. This section outlines policy and procedures for access to ceiling spaces containing or suspected of containing asbestos fireproofing, thermal insulation, or other asbestos containing material.
- B. Work that may disturb asbestos but is not intended to result in intentional asbestos removal shall be controlled in accordance with this section, as well as Cal/OSHA requirements for Class III asbestos work contained in California Code of Regulations, Title 8, Section 1529. Moving ceiling tiles or horizontal hatches to access ceiling spaces with asbestos fire proofing or containing debris from asbestos thermal insulation is Class III asbestos work. The University Representative may approve modifications to these procedures. This section outlines minimum requirements. Controls that exceed these requirements may be used.

#### PART II - Not applicable to this section

#### PART III - EXECUTION

##### 3.01 Training

- A. Personnel performing work in spaces containing or suspected of containing asbestos material shall have training which meets the requirements of Cal/OSHA Class III asbestos work that is specific to the work task to be completed. This training shall adhere to requirements as set forth in 40 CFR 763.92(a)(2).

##### 3.02 Competent Person

- A. During work in asbestos contaminated attic spaces, an asbestos Competent Person, as defined by 8 CCR 1529, shall be present at all times to oversee safe access and control measures. A Competent Person shall inspect the area to assure the controlled work area is properly established, and to determine that appropriate cleanup has occurred at the end of the work task. The Competent Person shall adhere to all requirements within their area of responsibility outlined in 8 CCR 1529.

##### 3.03 Standard Access/Egress Procedures from Mini-Enclosure

- A. Access into an attic space with asbestos shall be completed using a manufactured mini-enclosure, or an equivalent enclosure constructed on site. Use of a small HEPA filtered negative air unit attached or integrated with the mini-enclosure to create negative pressure in the enclosure is required. A HEPA filtered vacuum shall be present and available for use in the mini-enclosure. The mini-enclosure must be posted with the asbestos warning sign in accordance with Cal/OSHA Title 8 CCR 8 1529. Access into the enclosure must be restricted to trained personnel, who are required to wear full body coveralls and a respirator approved for asbestos. A sticky mat shall be present immediately outside of the mini-enclosure. Any debris generated by work activity must be cleaned up using a HEPA vacuum and wet wiping techniques. All mini-enclosures and HEPA vacuums must be re-certified by a third-party using DOP testing every 6 months.

- B. Disposable full body coveralls are required in all ICRA Class III and IV containment areas dealing with asbestos or presumed asbestos and shall be selected to provide protection of street clothes from particulates generated inside of the containment area. All work inside a mini enclosure for asbestos related work is considered ICRA Class III or IV. Disposable coveralls shall be changed if they become ripped and are no longer serviceable.
- C. Proper use of the disposable coveralls and use of the sticky mat shall be followed at all times for all workers and University employees, when it is required by the ICRA Permit. At no time shall workers leave the mini enclosure wearing soiled disposable coveralls and booties. At times, in select areas requiring sterile environments, it may be necessary to change from soiled disposable clothing into clean disposable clothing before exiting containment. Coveralls and booties are to be removed inside the mini-enclosure and placed into a labeled, secured, plastic asbestos waste bag before leaving the mini-enclosure.

### 3.04 Air Sampling

- A. Air sampling is required per 8 CCR 1529 to assess asbestos exposures when the project requires workers to enter the attic space if there is a reasonable possibility that the permissible exposure limit (PEL) may be exceeded. The air sampling frequency shall be sufficient to assess all work activities in the mini-enclosure and in the attic space and may include both 30-minute Excursion sample periods and longer sampling periods.

### 3.05 Debris Clean-up

- A. All debris inside of the mini-enclosure shall be cleaned up promptly by HEPA vacuuming and wet wiping techniques and before each time the mini-enclosure is moved. These techniques of minimizing asbestos fiber migration are outlined in 8 CCR 1529 and are to be strictly adhered to.

### 3.06 Personal Protective Equipment

- A. All personnel entering the attic space with known or presumed asbestos containing materials shall wear full body disposable coveralls (e.g., Tyvek, Kleenguard or equivalent) and at a minimum, a half face, tight fitting, elastomeric respirator with HEPA (P-100) filter cartridges for asbestos protection (or a respirator offering greater protection). The individual wearing this respirator must have been fit tested, trained and had medical clearance, pursuant to 8 CCR 5144.

### 3.07 Entering ceiling spaces where asbestos fire proofing (contaminated with assumed or visible asbestos debris) is present (e.g., when personnel must enter the space and "crawl" in the attic space, but asbestos will likely not be disturbed).

- A. Control of disturbance of asbestos debris during work inside of an attic space shall be followed in all cases, by using a HEPA vacuum to clean-up visible suspect asbestos containing debris in the immediate area of access and work. If practical, vacuum visible debris for the full path of travel. If this is not practical, use other procedures to ensure safe removal of visible debris in the path of travel that would be disturbed by the crawl. For example, wet paper towels and plastic bags may be used to pick up and contain visible debris. The top surface of the attic access panel shall be cleaned of all dust and debris using a wet paper towel before the access hatch panel is allowed to swing down into the suspended position. Other control methods may be used provided they meet the following criteria:
  - a. dry sweeping is not permitted
  - b. employees must not walk on, crawl on or otherwise crush visible suspect asbestos containing debris
  - c. the control method must not result in a release of airborne fibers.

- B. If the coverall tears or rips during the work activity, repair or replacement is required. Use duct tape to repair tears or rips to the coverall if feasible or exit and replace the coverall. Remove and bag coverall in mini-enclosure as in ceiling access procedure. If coveralls were torn, vacuum any noticeable debris from underlying clothing. Use two disposable coveralls to minimize contamination of street clothes when tearing is likely or when crawling on rough surfaces.
- 3.08 HEPA Filter Challenge Testing and Certification
- A. All HEPA filtered equipment (including negative air units and vacuums) used must have passed onsite DOP testing within the last 6 months and must be re-certified after filter replacement or if moved offsite, including to another University building.
- 3.09 Access for Inspection after Ceiling Tile has been Removed
- A. Inspection above the ceiling, after a ceiling tile has been moved using a mini-enclosure containment, may be performed with asbestos awareness training. Access of this type is limited to visual inspection through the ceiling opening. Full entry to the space or ceiling crawl must meet the other requirements of this section. Personnel who perform this work must be notified that asbestos is present in the area and which materials in the area contain asbestos.
- 3.10 Asbestos Waste Management
- A. Personnel are required to appropriately bag all asbestos debris, disposable personal protective equipment, and other materials potentially contaminated with asbestos. Bags shall be clear, 6 mil, imprinted with the required asbestos warning label. Appropriate packaging includes double-bagging and wetting the materials in the inner bag. Each bag shall be legibly marked with (Site address and Generator Number will change with each project site location) The Generator is UC Davis Health EPA ID No. CAD076124981. The Generator address is 2315 Stockton Blvd., FSSB 2500, Sacramento, CA 95817.
  - B. For those projects generating five (5) or fewer bags of asbestos-contaminated materials, University Environmental Health and Safety (EH&S) will manage the disposal of the bags; contact EH&S at 916-734-2740 for disposal with at least one week's notice of the intent to dispose. Materials must be bagged and marked as described above prior to EH&S' acceptance.
  - C. Asbestos disposal is the responsibility of the Contractor on those projects generating more than five (5) bags of asbestos-contaminated material. If a Uniform Hazardous Waste Manifest is required for transportation, such manifest must be signed by a representative of the University EH&S. Contact EH&S with at least one week's notice of the intent to dispose.

**END OF SECTION 01 56 20**

**SECTION 016100**  
**PRODUCT REQUIREMENTS**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Product Options
- B. Product Substitutions
- C. Product Transportation and Handling Requirements
- D. Product Storage and Protection
- E. Product System Completeness

1.02 RELATED SECTIONS

- A. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- B. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION
- C. Section 014100 – REGULATORY REQUIREMENTS
- D. Section 014500 – QUALITY CONTROL

1.03 PRODUCTS

- A. Product Selection: Provide products that comply with Contract Documents, are undamaged and unused at installation.
- B. Product Completeness: Provide products complete with all accessories, trim, finish, safety guards and other devices needed for complete installation and for intended use and effect.
- C. Products: Items purchased for incorporation in Work, whether purchased for project or taken from previously purchased stock; this includes materials, equipment, assemblies, fabrications and systems.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model designation indicated in the manufacturer's published product data.
  - 2. Materials: Products that are shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed or installed to form part of the Work.
  - 3. Equipment: A product with operating parts, whether motorized or manually operated, requiring connections such as wiring or piping.
- D. Specific Product requirements: Refer to requirements of Section 014500 – QUALITY CONTROL and other Sections in Division 2 through 49 for specific requirements for products.

- E. Code Compliance: All products, other than commodity products prescribed by Code, shall have current listing service report or research report. Minimum Requirements: Specified requirements are minimum requirements.
- F. Interchangeability: To fullest extent possible, provide products of the same kind from single source. Products supplied in quantity shall be same product and interchangeable throughout the Work. When options are specified for selection of any of two (2) or more products, product selected shall be compatible with products previously selected.
- G. Nameplates: Except for required labels and operating data, do not attach manufacturer's name plates or trademarks on surfaces exposed to view in occupied spaces or on the exterior of building.
- H. Equipment Nameplates: Provide permanent nameplate on each item or service-connected or power-operated equipment. Locate on inconspicuous accessible surface. Nameplate shall contain the following information and essential operating data:
  - 1. Name of product and manufacturer
  - 2. Model and serial number
  - 3. Capacity and Speed
  - 4. Ratings and other pertinent information
- I. Listing Service: Products, for which listing service standards have been established and for which their service label is available, shall bear the appropriate listing service label.

#### 1.04 PRODUCT OPTIONS

- A. Products Specified Only by Description: Where the Contract Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the appropriate characteristics and otherwise complies with the requirements.
- B. Performance Specification: Where Contract Specifications require compliance with performance requirements, provide products that comply and are recommended for application. Manufacturer's recommendations may be contained in Product literature, or by certification of performance.
- C. Compliance with Standards: Where Contract Specifications require compliance with a standard, select a product that complies with the standard specified.
  - 1. Wherever catalog numbers and specific brands or trade names followed by the designation "to match existing" are used in conjunction with product(s) required by the Contract Specification, no substitution will be considered.



- D. Products Specified by Naming One (1) or More Manufacturers:
1. Specified manufacturer(s): Provide specified product(s) of the specified manufacturer. Wherever more than one (1) manufacturer's product is specified, the first-named product is the basis for the design used in the Work and the use of alternative-named products or substitutes may require modifications in that design. If such alternatives are proposed by Contractor and are approved by University, Contractor shall assume all costs required to make necessary revisions and modifications to the design, including additional costs to University for evaluation of revisions and modifications of the design resulting from the substitutions submitted by Contractor.
    - a. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or equal" supporting data for second manufacturer's product, if proposed by Contractor, shall be submitted in accordance with the requirements for substitution.
  2. Quality Standard: Products(s) of the specified manufacturer shall serve as standard by which the product(s) of other named manufacturers are evaluated.
- E. "Or Equal" Provision: Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by Contract Specification to establish standard of quality, utility, and appearance required.
1. "Or Equal" Products: Equivalent products of manufacturers other than the specified manufacturer may be provided if determined by University's Representative to be acceptable in accordance with substitution provisions following:
    - a. Contractor shall submit to University's Representative, within thirty-five (35) calendar days after the date of commencement of the Work specified in the Notice to Proceed, a list in excel format containing Specification Section number with extension i.e. 088000 2.B.1.a. with descriptions of each product proposed for substitution.
    - b. Contractor shall provide supporting data as required herein.
    - c. University will evaluate Contractor's proposal. The decision of University shall be final.
    - d. University will accept, in writing, proposed substitutions that are in University's opinion equal in quality, utility and appearance to the product specified. Such acceptance does not relieve Contractor from complying with requirement of the Contract Documents.

- e. Contractor shall be responsible for all costs of any changes resulting from Contractor's proposed substitutions that affect other work, or the Work of Separate Contractor.
  - f. Failure to place orders for specified products sufficiently in advance of required date for incorporation into the Work will not be considered justification for Contractor to request a substitution or deviation from requirements of the Contract Documents. The sixty (60) calendar day submittal period does not excuse Contractor from completing the Work within the Contract Time.
- 2. Contractor's Determination: Prior to submitting "or equal" product(s) for consideration, Contractor shall review and determine product(s) meet or exceed the quality and warranty provisions of the specified product.
  - 3. Late Substitution Requests: If a request for substitution occurs after the sixty (60) calendar day period, the substitution may be reviewed at the discretion of University and the costs of such review, as approved by University, shall be deducted from the Contract Sum.
    - a. Product Availability Waiver: Substitutions will be considered after the sixty (60) calendar day period only when a product becomes unavailable due to no fault of the Contractor.
- F. Visual Matching: Where Contract Specifications require matching a sample, University's decision on proposed product match is final. If no product matches and complies with other requirements, comply with provisions for "substitutions" for selection of a matching product in another category.
- G. Visual Selection: Where requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product that complies with other requirements. University's Representative will select color, pattern and texture from the product line selected.

#### 1.05 SUBSTITUTIONS

- A. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract shall be considered "substitutions". The following are not considered substitutions:
  - 1. Revisions to Contract Documents requested by University's Representative or University's Consultant.
  - 2. Specified options of products and construction methods included in Contract Documents.
  - 3. Compliance with governing regulations and orders issued by governing authorities.

- B. Substitution Provisions: Requests for Substitutions will only be considered if Contractor submits the following data:
1. Furnish complete technical data including drawings, performance specifications, samples, test reports and any additional information required by University's Representative, for each product proposed for substitution.
    - a. Submit ONE (1) PDF file with bookmarks.
    - b. In reviewing supporting data for substitution, University will use, for purpose of comparison, all characteristics of Basis of Design specified product as it appears in manufacturer's published data even though all characteristics may not have been particularly mentioned in the Contract Specifications. If more than two (2) substitutions of supporting data are required, University's costs of reviewing additional supporting data will be deducted from the Contract Sum.
    - c. Submit statement indicating substitution's effect on the Construction Schedule, if any.
    - d. Submit cost information, including proposal of net deduction, if any, from Contract Sum.
  2. Furnish statement by Contractor that proposed substitution is in full compliance with requirements of Contract Documents and Applicable Codes.
  3. Provide a Comparison Table as part of the substitution request listing the design and performance criteria of the Basis of Design specified product with the proposed substitution product side by side. The design and performance criteria shall include but not limited to; size, thickness, gauge, strength, function, ASTM rating, test report data, manufacturing association standards & data, technical properties & performance data, traffic or weather resistance, quality assurance data, warranty and other design and performance criteria list in Basis of Design manufactures specification and written material.
  4. Furnish list of Subcontractors, if any, that may be affected by the substitution.
  5. If proposed substitution requires portions of the Work to be redesigned or removed in order to accommodate substituted product, submit design and engineering calculations prepared by the licensed design professional of record.
  6. Contract Document Revisions: Should Contractor-proposed or alternate sequence or method of construction require revision of Contract Documents, including revisions for purpose of determining feasibility, scope or cost, or revisions for the purpose of obtaining approval by governing authorities having jurisdiction, revisions will be made by University's Consultant who is the design professional of record.
    - a. Services of University's Consultants, including time spent in researching and reporting on proposed substitutions or alternate sequences and methods of construction, shall be paid by Contractor when such activities are considered additional services to the design services contracts of University.

- b. Cost of services by University's Consultants shall be paid on a time and material basis, based on current hourly fee schedules, with reproduction, long distance telephone and shipping costs reimbursable. Such fees shall be paid whether or not the proposed substitution or alternate sequence or method of construction is ultimately accepted by University and Change Order executed. Such fees owed shall be deducted from the Contract sum on the next Application for Payment.
- 7. Submit all proposed substitutions in writing to University using the Request for Substitution form provided at the back of this Section.
- C. University may reject any substitution not proposed as described above and presented within the time prescribed.
- D. Revisions to submittals: If University's Representative, in reviewing list of substitutions, requires revisions or corrections to previously accepted Shop Drawings and supplemental supporting data, Contractor shall promptly do so. If any proposed substitution is judged by University's Representative to be unacceptable, the specified product shall be provided at no cost to the University.
- E. Samples: Samples may be required. Tests required by University's Representative for determination of quality and utility shall be made by Contractor's independent testing Laboratory, at expense of Contractor, with prior University acceptance of test procedure.

#### 1.06 TRANSPORTATION, DELIVERY AND HANDLING

- A. Transport products by methods to avoid product damage.
- B. Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- C. Deliver products in undamaged condition in manufacturer's original sealed container or packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- D. Provide equipment and personnel to handle products by methods to prevent soiling, marring or other damage.
- E. Promptly inspect products on delivery to ensure products comply with Contract Documents, quantities are correct, and to ensure products are undamaged and properly protected. Promptly remove damaged or defective products from site and replace at no adjustment to the Contract Sum and/or Contract Time.

#### 1.07 STORAGE AND PROTECTION

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store products to facilitate inspection and measurement of quantity or counting of units.
- C. Store heavy materials away from structures in a manner that will not endanger supporting construction.

- D. Store sensitive products in weather-tight enclosures. Store products subject to damage by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation.
  - 1. Maintain temperature and humidity within range required by manufacturer's instructions.
  - 2. Exterior Storage:
    - a. Store products above ground on blocking or skids to prevent soiling, staining and damage.
    - b. Cover products that are subject to damage by the elements with impervious protective sheet coverings. Provide adequate ventilation to prevent condensation.
    - c. Store sand, rock, aggregate or other loose granular material in well-drained area on solid surfaces. Prevent mixing with foreign matter.
  - 3. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and maintained under required conditions, free from damage and deterioration.
- E. Protection After Installation: Provide barriers, substantial coverings, notices and other materials or methods as necessary to protect installed work from traffic, subsequent construction operations and weather.
  - 1. Maintain temperature and humidity conditions in interior spaces for Work in accordance with manufacturers' instructions for materials and equipment being protected.
  - 2. Remove protective measures when no longer required and prior to Acceptance of the Work.

1.08 SYSTEM COMPLETENESS

- A. The Contract Drawings and Contract Specification are not intended to be comprehensive directions on how to produce the Work. Rather, the Drawings and Specifications are instruments of service prepared to describe the design intent for the completed Work.
- B. It is intended that equipment, systems and assemblies be complete and fully functional even though not fully described. Provide all products and operations necessary to achieve the design intent described in the Contract Documents.
- C. Contractor is urged to report to University's Representative immediately when elements essential to proper execution of the Work are discovered to be missing or misdescribed in the Contract Documents or if the design intent is unclear.

- D. Should an essential element be discovered as missing or misdescribed prior to receipt of bids or establishing a negotiated Contract Sum, an Addendum or Clarification will be issued so that all cost may be accounted in the Contract Sum.
- E. Should an obvious omission or misdescription of a necessary element be discovered and reported after execution of the Agreement, Contractor shall provide the element as though fully and correctly described.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION**

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products.
- B. Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect to ensure freedom from damage and deterioration at time of Substantial Completion.

3.02 Refer to the following Attachment:

- A. Request for Substitution Form.

**END OF SECTION 016100**

**REQUEST FOR SUBSTITUTION**

**Substitution #:** \_\_\_\_\_ **Submittal #:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Project#:** \_\_\_\_\_ **HCAI#:** \_\_\_\_\_

**PROJECT NAME:** \_\_\_\_\_

|   |  |
|---|--|
| <b>TO: UC DAVIS HEALTH</b><br><b>Facilities Design &amp; Construction</b><br><b>4800 2<sup>ND</sup> Avenue, Suite 3010</b><br><b>Sacramento, CA95817</b><br><b>P: 916-734-7024</b><br><br><b>Attn.: (Project Manager's Email Address)</b> | <b>FROM:</b> _____<br>_____<br>_____<br>_____<br>_____ |
|---|--|

Name of Party Submitting Request for Substitution: \_\_\_\_\_

Reason for Submitting Request for Submission: \_\_\_\_\_

Specification Section and Paragraph #: \_\_\_\_\_

Substitution Manufacturer name and address: \_\_\_\_\_

Proposed substitution (trade name of product, model or catalog #): \_\_\_\_\_

Fabricators and Suppliers (as appropriate): \_\_\_\_\_

|  |
|--|
| <b>PRODUCT DATA:</b><br>ATTACH PRODUCT DATA AS SPECIFIED IN SPECIFICATION SECTION 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES<br><br>Similar projects using product (list dates of installation and names/phone numbers of Owners):<br>_____<br>_____<br>_____<br><br>Similar comparison of proposed substitution with specified product (indicate variation(s), and reference each variation to appropriate Specification Section paragraphs):<br><br><b>-ATTACH COMPARISON SUMMARY-</b> |
|--|

(SUBSTITUTION REQUEST CONTINUES)

Quality and performance comparison between proposed substitution and specified product:

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Availability of maintenance services and replacement materials: \_\_\_\_\_

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Effect of proposed substitution on Construction Schedule: \_\_\_\_\_

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Effect of proposed substitution on other work or products: \_\_\_\_\_

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## **SECTION 017200**

### **PREPARATION**

#### **PART I - GENERAL**

##### 1.01 SECTION INCLUDES

- A. Surveying and Field Engineering Services

##### 1.02 RELATED SECTIONS

- A. Section 014500 – QUALITY CONTROL
- B. Section 017800- CLOSEOUT SUBMITTALS

##### 1.03 REGISTRATION REQUIREMENT

- A. Contractor shall employ civil engineers/land surveyors, which are registered and licensed in the state of California and acceptable to the University.

##### 1.04 LINE AND GRADES

- A. Contractor shall provide all construction survey work required for accurate location of the Work. Horizontal and vertical control for the Work shall be from project reference marks as shown on Contract Drawings. University's decision will be final in all questions regarding proper location of work.
- B. Contractor shall verify final configuration of project during demolition work. Minor adjustments of work to accommodate existing field conditions shall be responsibility of Contractor.
- C. For work that connects to existing structures with new floors or roofs that align with existing conditions; Contractor shall verify new and existing elevations prior to constructing the new floor or roof structure. Adjust elevations accordingly so that the new and existing floors are level and lineup.
  - 1. University approval in writing is required for any deviations from the contract documents intent.
- D. Replace control points that may be lost or destroyed, base requirements on original survey control, at no increase in the Contract Sum.

#### **PART II - PRODUCTS – Not Applicable to this Section**

#### **PART III - EXECUTION**

##### 3.01 INSPECTION

- A. Verify locations of survey control points prior to starting work. Promptly notify University's Representative of any discrepancies discovered.

### 3.02 SURVEY REFERENCE POINTS

- A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to University's Representative.
- B. Promptly report loss or destruction of any reference point or relocation required to University's Representative. Replace dislocated survey points based on original survey control.
- C. All control points established for the project must be clearly shown on the record documents.

### 3.03 SURVEY REQUIREMENTS

- A. Establish minimum of three (3) permanent benchmarks on site, referenced to establish control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements, including pavements, stakes for grading, fill and topsoil placement, utility locations, slopes and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations and ground floor elevations.
  - 4. Controlling lines and levels required for mechanical and electrical work.
  - 5. Verify layouts as Work proceeds to assure compliance with required lines, levels and tolerances.
- C. Periodically certify layouts by same means.

### 3.04 RECORDS

- A. Maintain complete and accurate log of all control and survey work as it progresses Including but not limited to items indicated in 3.03, B. and 3.04, B.
- B. On completion of foundation walls, underground utilities and major site improvements, prepare certified survey showing all dimensions, locations, angles and elevations of construction. Provide as part of the As-Built Documents per Section 017800.

**END OF SECTION 017200**

**SECTION 01 73 00**  
**CUTTING AND PATCHING**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching Work.
- B. Hazardous Conditions Permit requirements for brazing, welding and other hot work.

1.02 RELATED SECTIONS

- A. Section 011100 – SUMMARY OF THE WORK
- B. Section 013100 – COORDINATION
- C. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- D. Section 015610 – AIRBORNE CONTAMINANTS CONTROL
- E. Section 016100 – PRODUCT REQUIREMENTS
- F. Individual Specifications Sections.
  - 1. Cutting and patching incidental to Work specified in this Section.
  - 2. Coordination with work in other Sections for openings required to accommodate Work specified in those other Sections.

1.03 SUBMITTALS

- A. Contractor shall complete and submit for review to University's Representative, a Coring/Sawcutting Form, included at the end of this Section, and obtain written authorization for University prior to the commencement of any dig activities. Contractor shall include all pertinent information with the Coring/Sawcutting Form and submit with detailed work plan fourteen (14) calendar days prior to desired coring/cutting activity.
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather-exposed or moisture-resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight-exposed elements.
  - 5. Work of University.
  - 6. Utility supply, drains, fire alarm, communication.
- B. Include in request:

1. Identification of Project, including University's Project Name and Project Number.
2. Location and description of affected Work.
3. Necessity for cutting and patching.
4. Description of proposed work, and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of University.
7. Written permission of University.
8. Date and time work will be executed.

#### 1.04 NOTIFICATIONS

- A. Before starting welding or cutting work involving the use of gas or electric welding equipment, or any brazing work involving gas or electric brazing equipment Contractor shall complete the online Hazardous Conditions Permit form at <https://health.ucdavis.edu/fire/>. Contractor shall allow seventy-two (72) Hours for Fire Marshal's approval and issuance of Hazardous Conditions Permit. This permit will be issued without cost to Contractor and may be applicable to more than one (1) building. Contractor shall be responsible for reporting to Fire Department either by telephone or in person at beginning and end of each day's work. Provide minimum written notice of fourteen (14) calendar days prior to such activities.
1. Welding and brazing personnel must be certified by a University or HCAI approved laboratory and must maintain this certification during the work of this Contract.
  2. Contractor is responsible for notifying University of all apparent locations where suspect asbestos containing materials may be present or discovered during the course of the project such as cement pipes or other insulated material, which may be a result of newly excavated materials below grade or after building systems are opened such as within wall, ceiling or subfloor spaces. When any such location is discovered by Contractor, information relating thereto shall be immediately communicated to University's Representative.
  3. Where welding and cutting activity is required and suspect painted surfaces are present that will be impacted by the welding or cutting activity, the contractor shall request from the University's Representative information regarding laboratory analysis for lead or other hazardous metals in the painted metal components before any cutting or welding is performed. The contractor shall refer to Section 013500 Special Procedures, 1.05 Hazardous Materials Procedures regarding materials impacted by welding and cutting activity.
  4. Contractor shall then follow any and all instructions as indicated by University's Representative.

## PART II - PRODUCTS

### 2.01 MATERIALS

- A. Product substitution: For any proposed change in materials, submit request for substitution under provision of SECTION 016100 – PRODUCT REQUIREMENTS. Use only materials for cutting, fitting, and patching which comply with the applicable Specification Sections, and which match adjacent materials. Use materials whose installed performance will equal or surpass that of existing materials.

### **PART III - EXECUTION**

#### **3.01 EXAMINATION**

- A. General: Execute cutting, fitting and patching including excavation and fill, to complete Work and:
  - 1. Fit the several parts together, to integrate with other work.
  - 2. Uncover work to install ill-timed work.
  - 3. Remove and replace defective and non-conforming work.
  - 4. Remove samples of installed work for testing.
  - 5. Provide openings in elements of Work for penetrations of mechanical and electrical work.
- B. Examination, General: Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
  - 1. After uncovering existing Work, inspect conditions affecting proper accomplishment of Work.
  - 2. Beginning of cutting or patching shall be interpreted to mean that existing conditions were found acceptable by Contractor.
- C. Ground Penetrating Radar: Determine by Ground Penetrating Radar all existing reinforcing, conduit and piping located in concrete walls and slabs prior to demolition. Clearly mark all locations and review with University Representative prior to demolition.

#### **3.02 PREPARATION**

- A. Temporary Supports: Provide supports to assure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Weather Protection: Provide protection from elements in all areas that may be exposed by uncovering work. Maintain excavations free of water.
- C. Protection. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas. Do not block required exit ways or stairs.
- E. Protect rated floor, wall and ceiling assemblies. Prior to cutting opening in a rated assemblies review with University's Representative and get written approval from the Fire Marshal.

### 3.03 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to properly complete Work.
- B. Coordinate installation or application of products for integrated Work.
- C. Uncover completed Work as necessary to install or apply products out of sequence.
- D. Remove and replace defective or non-conforming Work.
- E. Provide openings in the Work for penetrations of mechanical and electrical Work.
- F. Provide cutting and patching to accommodate all demolition work as part of this contract. Provide level and plumb cuts at locations that will be exposed or to provide smooth and even surface for patching to existing work or surfaces.
- G. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

### 3.04 PERFORMANCE

- A. Execute cutting and patching by methods to avoid damage to adjoining Work, and that will provide appropriate surfaces to receive final finishing.
- B. Execute cutting and patching of weather-exposed, moisture-resistant and sight-exposed surfaces by methods to preserve weather, moisture and visual integrity.
- C. Restore work with new Products as specified in individual Sections of Contract Documents.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior approval from University. Coordinate timing of all sawing and cutting work with the University's Representative. Do not over saw cut corners and intersection unless written authorization is provided from the University Representative and the Structural Engineer of Record.
- E. Fit work neat and tight allowing for expansion and contraction. Butt new finishes to existing exposed structure, pipes, ducts, conduit, and other penetrations through surfaces.
- F. At penetrations of firewalls, partitions, ceiling, or floor construction, completely seal voids with UL approved fire-rated assembly. Provide temporary closures at the end of each workday. Closures shall be approved by the University Fire Marshal.
- G. Refinish surface to match adjacent finish. For continuous surfaces, refinish to nearest intersection, corner or natural break and from floor to ceiling. For an assembly, refinish unit. All patched surfaces from new to existing shall provide a smooth and even transitions aligning with the adjacent surface with no visible marks, joints, seams, sheen, texture or color difference.
- H. Where new construction is to join with or match existing work, it shall be finished exactly to that work so as to form a complete unified and finished element.
- I. Visual Requirements: Do not cut and patch operating elements or related components in a manner that would, in the University's Representative's opinion, reduce the building's

aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner, including by not limited to.

1. Repair and patch in areas where finishes have been visually disturbed by cutting and patching to the nearest intersections.
2. Processed concrete finishes
3. Firestopping
4. Acoustical ceilings
5. Flooring
6. Carpeting

3.05 Refer to the Following Attachment

- A. Coring/Sawcutting Notification

**END OF SECTION 01 73 00**

**CORING/SAWCUTTING NOTIFICATION**

LOCATION: \_\_\_\_\_ PROJECT#: \_\_\_\_\_  
TITLE: \_\_\_\_\_

TRACKING NUMBER: \_\_\_\_\_  
(Provided by PO&M)

HCAI #: \_\_\_\_\_ DATE: \_\_\_\_\_

|  |                    |
|--|--------------------|
| <b>TO: Facilities Design &amp; Construction</b><br><b>UC Davis Health</b><br><b>4800 2<sup>nd</sup> Avenue, Suite 3010</b><br><b>Sacramento, CA 95817</b><br><b>P: 916-734-7024</b><br><b><u>(Project Manager's email address)</u></b> | <b>FROM:</b> _____ |
|--|--------------------|

SCOPE: \_\_\_\_\_

HAS USA BEEN NOTIFIED?  YES  NO *When?* \_\_\_\_\_

ARE ALL KNOWN UTILITIES MARKED?  YES  NO *By Whom?* \_\_\_\_\_

LOCATION OF WORK SHOWN ON ATTACHED SITE PLANS?  YES  NO *Purpose:* \_\_\_\_\_

DATE(S) CORING OR SAWCUTTING WILL TAKE PLACE: \_\_\_\_\_ Signed: \_\_\_\_\_

| <b><u>UC DAVIS HEALTH USE ONLY</u></b>  |  |
|---|--|
| DATE RECEIVED: _____  |  |
| WHO FROM UNIVERSITY WILL AUTHORIZE, SUPERVISE AND VERIFY?<br>PHONE: _____                         |  |
| Utilities Verified by IOR?  | <input type="checkbox"/> YES <input type="checkbox"/> NO   |
| Activities coordinated with:  | <input type="checkbox"/> PO&M <input type="checkbox"/> Fire <input type="checkbox"/> Telecom <input type="checkbox"/> Occ. Safety<br><input type="checkbox"/> Other (Itemize): _____ |
| COMMENTS:<br><br>Signed: _____<br>DATE AUTHORIZED: _____ University Representative<br>PO&M: _____ |  |
| COMPLETION DATE: _____  |  |
| COMMENTS:<br>(Unknown Utilities Encountered,<br>Disruptions, Successes, Weather,<br>etc.)         |  |
| SIGNED: _____   |  |
| Copies to: University Consultants, PO&M, Fire, Telecom, File, Others:                             |  |



## SECTION 01 74 00

### CLEANING

#### PART I - GENERAL

##### 1.01 SECTION INCLUDES

- A. Construction Cleaning.
- B. Requirements for cleaning during progress of Work, at Substantial Completion of Work and at Acceptance of Work.
- C. Disposal of waste materials, debris and rubbish during construction.

##### 1.02 RELATED SECTIONS

- A. General Conditions of the Contract: Cleanup.
- B. Additional Requirements: Cleaning for specific products or elements of Work are described in Specification Sections describing that Work.
- C. Section 015610 Airborne Contaminants Control have procedures and practices that shall be implemented and followed by the Contractor for this project.
- D. Section 013900 Green Building Policy Implementation: Waste Management Program

#### PART II - PRODUCTS

##### 2.01 MATERIALS

- A. Use only those cleaning agents and materials that will not create hazards to health or property and that will not damage surfaces.
- B. Use only those cleaning agents, materials and methods recommended by manufacturer of the material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning agent manufacturer.

##### 2.02 EQUIPMENT

- A. Provide covered containers for deposit of waste materials, debris, and rubbish.
- B. Provide at each entry point to the Work, and at other areas as directed by University's Representative, a clean room sticky mat. Replace mats daily or as requested by University Representative.

### **PART III - EXECUTION**

#### **3.01 CLEANING**

- A. Construction Cleaning: During Construction, maintain buildings, premises and property free from waste materials and rubbish. Dispose of such waste and debris at reasonable intervals off of University property.
1. Maintain areas under Contractor's control free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.
  2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to closing such spaces.
    - a. All horizontal surfaces above ceilings shall be cleaned prior to ceiling closer.
  3. After every concrete placement clean all wet concrete from all surfaces.
    - a. Interior and exterior
  4. Clean interior areas daily to provide suitable conditions for Work. Remove debris from areas of work on a daily basis at a minimum, or more often as required to provide suitable conditions for work.
  5. Broom clean with sweeping compound or HEPA Vacuum interior areas prior to start of surface finishing, and continue cleaning on an as needed basis.
  6. Control cleaning operations so that dust and other particles will not adhere to wet or newly coated surfaces.
  7. Provide a mat, as specified above, for project entrances and exits. Item to be of sufficient size to allow personnel exiting project site to clean debris and dust from shoes. Tracking dust and debris through working areas of hospital and/or related buildings is not acceptable.
  8. Any dust or debris tracked out of the construction site, either by foot traffic or by debris hauling vehicles shall be cleaned by the contractor. If the dirt or other debris is determined by the University's Representative to be from the contractor's activities at the jobsite it shall be cleaned in a timely manner regardless of how far from the site it is.
- B. Conduct cleaning and disposal operations in compliance with Waste Management Program per 013900 and all applicable codes, ordinances, regulations, including anti-pollution laws.

#### **3.02 SUBSTANTIAL COMPLETION CLEANING**

- A. Execute a thorough cleaning prior to Substantial Completion review by University's Representative.

- B. At roof areas remove all unused materials and construction waste including but not limited to screws, nails, fasteners, sheet metal cuttings, scrapes, oil, grease and adhesive. Wash down roof horizontal and vertical surfaces. Clean out all debris at roof drains.
- C. Clean walkways, driveways and streets by thorough brooming and wash-down.
- D. Clear debris from storm drainage lines and ways, leaving site ready for stormy weather.
- E. Rake landscaped areas clean.
- F. Remove waste and surplus materials, rubbish and temporary construction facilities, utilities and controls.
- G. Disinfect containment and protection areas as directed by University Representative.
- H. For Airborne Contamination areas: Construction cleaning use wet cleaning methods and HEPA-filtered vacuum cleaners are required to minimize release of airborne contaminants. Contain waste materials, debris and rubbish.

### 3.03 FINAL COMPLETION CLEANING

- A. Complete final cleaning before submitting final Application for Payment.
- B. Employ professional building cleaners to thoroughly clean building immediately prior to final inspection.
- C. Remove the following but not limited to concrete splatters, paint splatters, pencil marks, pen marks, chalkline marks, tape, protective films & coatings, grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from all sight-exposed interior and exterior surfaces.
- D. Restore damaged or marred surfaces.
- E. Remove dust from all horizontal surfaces not exposed to view, including light fixtures, ledges and fixture lenses.
- F. Clean and polish all glass, mirrors, and bright metal work. Clean and disinfect all plumbing fixtures.
- G. Damp wash all resilient flooring. Waxing of resilient flooring shall be done by the University.
- H. Thoroughly sweep all floors and vacuum all carpets.
- I. Cleaning of Work provided by University under separate contracts, will not be required except if soiled by construction activities under this Contract.
- J. Thoroughly clean and polish all resilient flooring, metal and plastic surfaces; remove labels and protective coatings.
- K. Replace filters and clean heating and ventilating equipment used for temporary heat and ventilation.

- L. Remove waste material or equipment that has been damaged, touch up and /or repair exposed areas; such repairs to be approved by University's Representative.
- M. Should final cleaning be inadequate, as determined by University's Representative, and Contractor fails to correct conditions, University's Representative may order thorough cleaning and deduct the cost from Final Payment.

3.04 FINAL COMPLETION SITE CLEANING

- A. Broom clean exterior paved surfaces. Rake clean other surfaces of the grounds.
- B. Power Wash, Hose down and scrub where necessary all concrete and walks dirtied as a result of the construction work. Thoroughly remove mortar droppings from all walks and pavements.
- C. Remove from the site all tools, equipment, construction waste, unused materials, excess earth, and all debris resulting from the Work.

3.05 DISPOSAL

- A. Conduct cleaning and disposal operations in compliance with all applicable codes, ordinances, regulations, including anti-pollution laws.
- B. Do not bury or burn rubbish or waste material on University premises.
- C. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
- D. Remove waste materials, debris, and rubbish from site and dispose of off-site.

3.06 INSPECTION

- A. Prior to Beneficial Occupancy, Substantial Completion or Final Completion; Contractor and University's Representative shall jointly conduct an inspection of sight-exposed interior and exterior surfaces to verify that entire Work is clean.

**END OF SECTION 01 74 00**

**SECTION 01 75 00**  
**STARTING AND ADJUSTING SYSTEMS**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Procedures for Starting Systems

1.02 RELATED SECTIONS

- A. Section 018100 – PLUMBING/HVAC TESTING PROCEDURES
- B. Section 018200 – DEMONSTRATION AND TRAINING
- C. Section 019100 - COMMISSIONING
- D. Division 22
- E. Division 23
- F. Division 25
- G. Division 26
- H. Division 27

1.03 SUBMITTAL REQUIREMENTS

- A. Submit preliminary schedule listing times and dates for start-up of each item of equipment in sequence in writing, minimum of ninety (90) calendar days prior to any start-up.
  - 1. Start up, testing and Commissioning of equipment shall be integrated and coordinated with the contract schedule.
    - a. Adjustments will be made as project progresses, but the sequencing will be maintained.
- B. Submit manufacturer's representative reports within one (1) week after start-up, listing satisfactory start-up dates.
- C. Provide information, manufacturer and model number of all testing equipment to be used and current certification that the testing equipment has been calibrated within the last 6 months.
- D. Maintain log with dates and results of Starting and Adjustments, and provide electronic copy to University's Representative.

#### 1.04 PROJECT CONDITIONS

- A. Building enclosure shall be complete and weather-tight.
- B. Excess packing and shipping bolts shall be removed.
- C. Interdependent systems shall have been checked and made operational.
- D. Permanent Power is connected and operational to the building.

#### **PART II - PRODUCTS – Not Applicable to this Section**

#### **PART III - EXECUTION**

##### 3.01 INSPECTION

- A. Verify Project conditions comply with requirements for start-up.
- B. Verify status of Work meets requirements for starting equipment and systems.

##### 3.02 PREPARATION

- A. Coordination: Coordinate sequence for start-up of various item of equipment.
- B. Notification: Notify University in writing, minimum of fourteen (14) calendar days prior to start-up of each item of equipment.
- C. Contractor Quality Assurance Manager shall take the lead role for Starting and Adjusting the equipment; coordinate and work with the University's Representative and Inspectors throughout the entire process.
  - 1. Coordinate all start-up with the Commissioning Agent for the project.
- D. Information on hand: Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.
- E. Verify each piece of equipment is anchored correctly per the manufacturer's requirements and the Contract Documents prior to energizing or starting.
- F. Verify each piece of equipment is connected to the correct power source, the breaker and conductors are the correct size. Overcurrent protection in place and required shut offs adjacent to the equipment are in place.
- G. Verify each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, and other conditions that may cause damage prior to energizing or starting.
- H. Verify control systems are fully operational in automatic mode.
- I. Manufacturer's Criteria: Verify tests, meter readings and specific electrical characteristics agree with electrical equipment manufacturers' criteria.

- J. Bearings: Inspect for cleanliness: clean and remove foreign matter, verify alignment. Take corrective action as required.
- K. Drives: Inspect for tension on belt drives, adjustment of vari-pitch sheaves and drives, alignment, proper equipment speed, and cleanliness. Take corrective action as required. Verify shaft grounding protection is in place.
- L. Motors: Verify motor amperage agrees with nameplate value. Inspect for conditions that produce excessive current flow and that exist due to equipment malfunction. Take corrective action as required. Verify shaft grounding protection is in place.

### 3.03 STARTING SYSTEMS

- A. Execute start-up under supervision of responsible Contractor personnel.
- B. Place equipment in operation in proper sequence in accordance with sequencing schedule and the contract schedule.
- C. Follow manufacturer's requirements and recommendations for Starting and Adjusting, including any University requirements that may be listed in the Contract and Construction Documents.
- D. Equipment manufacturers representatives shall be on site for Starting and Adjusting that equipment.
- E. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- F. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- G. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 01 75 00**

## **SECTION 017600**

### **PROTECTION of EXISTING and INSTALLED CONSTRUCTION**

#### **PART I - GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Protection for Products Including University Provided Products, After Installation.
- B. Protection of Existing Utilities, Interference and Underground Structures.
- C. Protection of Existing Structures and Work adjacent to new construction and demolition.

##### **1.02 RELATED SECTIONS**

- A. Section 013100 – COORDINATION
- B. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION
- C. Section 015100 – TEMPORARY UTILITIES

##### **1.03 EXISTING UTILITIES**

- A. **Known Utilities:** Known existing utilities are shown on Contract Drawings in approximate locations. Contractor shall exercise care in avoiding damage to existing facilities. Contractor shall be responsible for repair of same if damaged through Contractor's action. Hand excavation shall be utilized when digging in close proximity to existing utilities. University does not guarantee that all utilities or obstructions are shown, or that locations indicated are accurate.
- B. As part of the Contract Work the investigation and excavation to locate existing utilities and underground structures shall be as follows, Contractor shall assume the existing known utility is within a 5 feet zone on either side of the location indicated on the Contract Documents. If the existing known utility is not located within a 5 feet zone on either side of the location indicated on the Contract Documents, the Contractor shall immediately notify the Universities Representative. The Contractor shall continue excavating until the existing utility is located. The Contractor shall be compensated for any additional excavation beyond the 5 feet zone on either side of the existing utility per 1.03D.
- C. **Electrical Equipment:** No work shall be performed on energized electrical equipment unless scheduled with University's Representative. University reserves right to specify specific conditions for all work involving energized high voltage electrical equipment and its scheduled modification proposal.



- D. Uncovering Facilities: Prior to any earthwork for new construction, Contractor shall uncover all existing piping where crossings, interferences or connections are shown on Contract Drawings, from one (1) foot below proposed construction limit to the existing ground surface. Any variation in actual elevations and indicated elevations shall be brought to University's Representative attention. If Contractor does not expose all existing utilities, Contractor shall not be entitled to additional compensation for work necessary to avoid unknown interferences.
- E. Interferences: If interferences occur at locations other than general locations shown on Contract Drawings, and such utilities are damaged before such locations have been established, or create an interference, Contractor shall immediately notify University's Representative and a method for correcting said interference shall be supplied by University. Payment for additional work due to interferences not shown on Contract Drawings shall be in accordance with the General Conditions of the Contract. Cost of repair to damaged utilities shall be deducted from the Contract Sum.
- F. Accuracy of Drawings: Drawings showing location of equipment, piping, etc. are diagrammatic and job conditions will not always permit installations in locations shown. When a conflict situation occurs, immediately bring to attention of University's Representative for determination of relocation.
- G. Deviations from Drawings: Information shown relative to existing power and signal service is based upon available records and data but shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made at no change to the Contract Sum.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - EXECUTION**

**3.01 PROTECTION AFTER INSTALLATION**

- A. Installed Equipment and Materials: Adequately protect all installed equipment and materials until completion and acceptance by University's Representative.
- B. Existing Facilities: All existing areas, improvements and facilities shall be protected from damage of any type resulting from operations, equipment or workers of Contractor during the construction process.
- C. Subsequent Operations: Protect installed products and control traffic in immediate area to prevent damage from subsequent operations.
- D. Traffic Areas: Provide protective coverings at walls, projections, corners, and jambs, sills, and soffits of openings in and adjacent to traffic areas.
- E. Elevators: Cover walls and floors of elevator cabs, and jambs of cab doors, when elevators are used by construction personnel. Protect the elevator call buttons, switches, communication devices, lights, thresholds and other components.
- F. Moisture and Humidity Protection: Protect all new installed work and existing work per the manufacturer's requirements from moisture or humidity damage including but not limited to stored materials, finishes, gypsum board, insulation, doors, casework, millwork, equipment and all other building components.
- G. Finished Floors: Protect finished floors and stairs from dirt, wear, and damage:

1. Secure heavy sheet goods or similar protective materials in place, in areas subject to foot traffic.
  2. At all transitions to adjacent areas not under construction.
  3. Lay rigid materials in place in areas subject to movement of heavy objects and where storage of products will occur.
- H. Waterproofed and Roofed Surfaces:
1. Restrict use of surfaces for traffic of any kind, and for storage of products.
  2. When an activity is mandatory, obtain recommendations for protection of surfaces from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.
  3. No Construction work shall be conducted on any unprotected roof weather new or existing.
  4. All pathways to work on the roof shall be protected.
- I. Lawns and Landscaping: Restrict traffic of any kind across planted lawn and landscaped areas.
- J. Adjacent Facilities: Care shall be exercised to prevent damage to adjacent facilities including walks, curbs, and gutters. Adequate protection shall be placed where equipment will pass over such obstructions, and facilities damaged by construction operations shall be removed and replaced at Contractor's expense.

### 3.02 Protection of Existing Structure and Work adjacent to new construction and demolition.

- A. The Contractor shall protect existing in place work at the exterior and interior, including but not limited to finishes, materials, products, utilities, fixtures, and equipment adjacent to new construction and demolition. Any existing in place work at the exterior and interior that is damaged by the Contractor shall be repaired or replaced at no extra cost to the University.
- B. Overloading: Contractor shall be responsible for overloading any part or parts of structures beyond the calculated capacities of the design. Placing materials, equipment, tools, machinery, or any other item shall be done with care to avoid overloading. No loads shall be placed on floors or roofs before they have attained their permanent and safe strength.
- C. Damaged Work: All damaged work shall be replaced, repaired, and restored to its original condition without change to the Contract Sum. Repair or replace all damaged work promptly as directed by University's Representative.
- D. Damaged Utilities: Where existing utilities are damaged or disrupted on account of any act, omission, neglect, or misconduct of the Contractor in the manner or method of executing the Work, or due to non-execution of work, such damage shall be immediately repaired to maintain operation regardless of the time of occurrence.
- E. Temporary Construction: Provide temporary construction necessary for protection of building and its parts. Close in buildings as soon as possible to protect from weather and vandalism. Protect existing buildings and controlled temperature areas from damage.

- F. Doors and Casework: Protect doors, millwork and mill counters and cases and hardware from damage, including abrading and scratching of finishes. Protect doors and frames and hardware from mechanical damage and damage to anodic coatings.
- G. Protective Coatings: Remove protective coatings, etc., as required to leave work in condition for painting and finishing, final cleaning, etc.
- H. Exterior Work: Protect all exterior work, including existing asphalt paving and landscaping and buildings.

**END OF SECTION 017600**

**SECTION 01 77 00**  
**CLOSEOUT PROCEDURES**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Project Closeout Procedures
- B. Contract Closeout Procedures
- C. Punch List of Incomplete Work or Corrections

1.02 RELATED SECTIONS

- A. Section 013100 – COORDINATION
- B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES: Administrative general requirements for submittals.
- C. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION
- D. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS: Removal of Controls.
- E. Section 017400 – CLEANING: Final Cleaning.
- F. Section 017800 – CLOSEOUT SUBMITTALS

1.03 FINAL COMPLETION ACTIONS

- A. On Application for Payment that coincides with date Substantial Completion is claimed, show 100% completion for portion of Work claimed substantially complete.
- B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
- C. Notify the University's Representative fourteen (14) calendar days prior to the Project being ready for permanent cores and keying.
- D. Complete start-up testing and Commissioning of systems, and instruction of University personnel. Remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.

1.04 SUBSTANTIAL COMPLETION REVIEW

A. Preliminary Punch List Review:

1. **Contractor** shall provide an electronic file as indicated in Item 1.04, C., (Preliminary Punch List) of items not installed, to be completed, not functioning correctly or to be corrected. The list shall include the anticipated dates of when the work is to be installed, completed or corrected.
2. Organize the List per Item 1.04, C.
3. List shall identify items by location (e.g., room number and name) and consecutive number (e.g., 307-5 might identify item 5 in room 307, Roof-4 would identify item 4 on Roof).
4. Segregate architectural, plumbing, HVAC and electrical Work on separate lists.
5. University's Representative and **Contractor** shall conduct a brief walk-through of Project to review scope and adequacy of list.

B. **Contractor's Certification:** When determined by **Contractor** that Work is substantially complete, **Contractor** shall notify University's Consultant and University's Representative.

1. Submit to University's Representative written certification that:
  - a. Contract Documents have been reviewed.
  - b. All portions of Work have been carefully inspected.
  - c. Work is complete in accordance with Contract Documents.
  - d. Equipment and systems have been commissioned, tested, adjusted and balanced and are fully operational.
  - e. Indicate Operation of systems that have been demonstrated to University personnel and which systems have not been demonstrated to University personal.
  - f. Work is ready for University's Consultant's Substantial Completion review.
2. Provide minimum fourteen (14) calendar days' notice to University's Representative prior to desired date for Punch List review.

- C. Organization of List (Punch List):
1. 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.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Format Requirements: Provide the following:
    - a. Organized electronic file that is able to be filtered or queried by the following categories:
      - 1) Contractor or Subcontractor
      - 2) Building Area/Floor if applicable
      - 3) Room Number or specific interior or exterior area.
      - 4) Photo Number if applicable
      - 5) Open or Closed
      - 6) Columns for use by University's Representative
        - a) Responsible Design Consultant
      - 7) Comments
    - b. Other Punchlist Software may be used if approved by the University's Representative.
    - c. Include the following information at the top of each page:
      - 1) Project name and Number.
      - 2) Date.
      - 3) Name of University's Representative.
      - 4) Name of **Contractor**.
      - 5) Page number.
- D. Punch List Review: University's Representative and University's Consultants as may be required, will attend a Contract closeout review and conduct a walk-through of Project to review **Contractor's** list of items to be completed and corrected (Punch List). **Contractor** and University's Consultant shall note deficiencies, if any.
1. **Contractor** shall prepare list and record additional items as University's Representative may determine require completion and correction from walk-through.

- a. If deficiencies are noted University's Representative and University's Consultant shall promptly notify **Contractor** in writing, listing observed deficiencies.
  - b. If no deficiencies are noted, or when noted deficiencies are removed from the Punch List, University's Representative shall promptly notify **Contractor**.
2. **Contractor** shall edit the electronic file and distribute list with University's Representative and University's Consultant's additions.
  3. **Contractor** shall remedy deficiencies.
  4. Costs of additional visits to site by University's Consultants to review completion and correction of Work shall be deducted from the Contract Sum.
- E. Uncorrected Work: Refer to requirements specified in SECTION 014500 – QUALITY CONTROL regarding Contract adjustments for non-conforming work.
- F. Cleaning and Clearing: Prior to Substantial Completion review, execute cleaning and clearing site of temporary facilities and controls, as specified in SECTION 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS and SECTION 017400 CLEANING
- G. Testing and Inspection: Prior to Substantial Completion review, complete all tests and inspections and submit applicable reports and approvals. Provide commissioning of building systems per Section 013900 GREEN BUILDING POLICY IMPLEMENTATION.
1. Complete materials tests and inspections.
  2. Complete commissioning, testing, inspection, balancing, sterilization and cleaning of plumbing and HVAC systems.
  3. Complete commissioning, testing and inspection of electrical system.
  4. Complete commissioning and operational tests of equipment.
  5. IF HCAI PROJECT: Submit electronic file of **Contractor**'s Final HCAI Verified Reports to University's Representative certifying completion of the Work in conformance with the Contract Documents. Report forms will be supplied by University's Representative.
- H. Acceptance of the Work shall not relieve **Contractor** of any responsibility for defects that develop during the guarantee period and are caused by **Contractor**'s failure to perform work in accordance with requirements of Contract Documents.

1.05 FINAL COMPLETION SUBMITTALS (See 017800 CLOSEOUT SUBMITTALS)

1.06 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to Contract Sum indicating:

1. Original Contract Sum
2. Previous Change Orders
3. Changes under allowances (Mark as NOT USED if not project applicable.)
4. Changes under unit prices (Mark as NOT USED if not project applicable.)
5. Deductions for uncorrected work
6. Penalties
7. Deductions for liquidated damages
8. Deductions for re-inspection fees
9. Other adjustments to Contract Sum
10. Total Contract Sum as adjusted
11. Previous payments
12. Sum remaining due

B. University will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.07 APPLICATION FOR FINAL PAYMENT

A. Final Payment: After completion of all items listed for completion and correction, after submission of all documents and products, and after final cleaning, submit final Application for Payment, identifying total adjusted Contract Sum, previous payments and sum remaining due. Refer to SECTION 012900 – MEASUREMENT AND PAYMENT and the General Conditions of the Contract.

B. Submit As-Built Documents to University's Representative with final Application for Payment.

**PART II - PRODUCTS – Not Applicable to this Section**

**PART III - PART III - EXECUTION**

3.01 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.

3.02 REPAIR PERIOD (GUARANTEE OR WARRANTY PERIOD)

- A. Upon acceptance of the project or a portion thereof from the **Contractor**, the "Guarantee to Repair Period" of one year or more will begin as described in Article 9 of the General Conditions. The University Representative will become responsible for receiving notices of Defective Work from building occupants and securing **Contractor** compliance where applicable. The University Representative shall have prime responsibility for follow-up & monitoring of **Contractor** activities. (Refer to Article 12 of General Conditions).
1. If the **Contractor** must "Shut-down" the fire and security alarms in an occupied building, then the **Contractor** shall be responsible to provide a fire and security watch until the system, at no additional cost to the University.

**END OF SECTION 01 77 00**

**SECTION 017800**  
**CLOSEOUT SUBMITTALS**

**PART I - GENERAL**

1.01 SECTION INCLUDES

- A. Equipment Data
- B. Operation and Maintenance Instructions
- C. Instruction of University personnel
- D. Schedule of Submittals
- E. Spare Parts and Maintenance Materials
- F. Guarantees, Warranties, Bonds, Service and Maintenance Contracts
- G. Project As-built Documents

1.02 RELATED SECTIONS

- A. Section 013100 – COORDINATION
- B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- C. Administrative general requirements for submittals.
- D. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION
- E. Section 014500 – QUALITY CONTROL: Manufacturer's tests and inspections as a condition of warranty.
- F. Section 014550 – INSPECTION AND TESTING OF WORK
- G. Section 016100 – PRODUCT REQUIREMENTS
- H. Section 017700 – CLOSEOUT PROCEDURES

1.03 FILE FORMATS

- A. All printed documents submitted per this section shall be in PDF format
  - 1. The PDF files will be unlocked and searchable.
  - 2. All PDF documents will be bookmarked.
  - 3. The exception to electronic format for As-Built drawings will be noted in the specific specification section where they are required.
- B. Digital Photography

1. All files will be submitted in JPEG
- 1.04 EQUIPMENT DATA AND OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS
- A. Preparation of data shall be done by persons:
    1. Trained and experienced in maintenance and operation of described products.
    2. Familiar with requirements of this Section.
    3. Skilled in technical writing to extent required for communication of essential data.
    4. Skilled as drafters competent to prepare required drawings
  - B. O&M Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at time of Section Submittals. Submit reviewed manual content formatted and organized as required by this Section. Prepare in the form of a data and instructional manual.
  - C. Submit PDF electronic files of operation and maintenance manuals. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the University. The exception to electronic format will be indicated in the specific specification section requiring hard copies of the manual.
    1. Name each indexed document file in composite electronic index with applicable item name. Include a completed electronically linked operation and maintenance directory.
      - a. List Project title and Project number and particular building as applicable.
      - b. Enable inserted reviewer comments on draft submittals.
    2. Organization: Arrange content by systems under Section numbers and sequence in accordance with the Project Specifications Table of Contents.
  - D. Table of Contents, Each Volume: Provide title of Project, Project number, with names, addresses, and telephone numbers of University's Representative, as applicable, and Contractor, including name of contact person. Provide schedule of products and systems, indexed to content of the volume.
    1. For each Product or System: List names addresses and telephone numbers of subcontractor, original supplier and manufacturer, as applicable, including name of contact person. Include name and address of local source of supplies and replacement parts.
    2. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete information not applicable.
    3. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project As-Builts Documents as maintenance drawings.
    4. Additional Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 014500 – QUALITY CONTROL.
    5. Warranties and Bonds: Include in each applicable section.

E. Manual for Materials and Finishes:

1. Building Products, applied Materials, and Finishes: Provide PDF composite electronically indexed file. Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.
2. Instruction for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
3. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
4. Additional Requirements: As specified in individual Specification Sections.
5. Table of Contents: Provide PDF electronic file with links to individual sections.

F. Manual for Equipment and Systems

1. Record Instructions: Forward to University's Representative, upon completion of work, and before work will be considered for acceptance, complete PDF composite electronically indexed file of instructions of entire plant and component parts, including manufacturer's certificates, warranty slips, parts lists, descriptive brochures, and maintenance and operating instructions, in quantities set forth in various Divisions. Submit drafts for review before preparing final PDF electronic file.
2. O & M Instructions: Provide and install, where directed, printed sheet under clear plastic cover, giving concise operating and maintenance instruction for equipment.
3. Each Item of Equipment and Each System: Inclusive description of unit or system, Model Number, Serial Number, and component parts. Identify function, normal characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts. Best to include all information provided in final approved equipment submittal. Design drawing shall be updated to reflect what was actually provided.
4. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.
5. Wiring Diagrams: Include color-coded wiring diagrams as installed.
6. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.
7. Maintenance Requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and re-assembly instructions; and alignment, adjusting, balancing, and checking instructions. Provide servicing and lubrication schedules, and list of lubricants required.
8. Instructions: Include manufacturer's printed operation and maintenance instructions. Include sequence of operation by controls manufacturer.
9. Parts Data: Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance. Provide list of original

- manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
10. Control Data: Provide as installed control diagrams by controls manufacturer.
  11. Piping Data: Provide Contractor's coordination drawings, with color piping diagrams as installed. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  12. Design Data: Provide a listing in table of Contents for design data, with tabbed binder divider page and space for insertion of data.
  13. Reports: Include test and balancing reports as specified.
  14. Additional Requirements: As specified in individual Specification Sections.
- G. Instruction of University's Personnel: Instruct University designated personnel to their full and complete understanding, procedures necessary to operate and maintain equipment and systems on continuing basis. Provide training of staff.
1. Schedule: Before final inspection, instruct University designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months of completion.
  2. Basis of Information: Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
  3. Instructional Material: Prepare and insert additional data in the manual when need for such data becomes apparent during instruction.
- H. Equipment Data and Operation and Maintenance Instructions Submittals:
1. Submittals: Comply with administrative requirements specified in SECTION 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  2. Preliminary Draft O&M Submittal: Submit electronic files of each manual at least **[180]** calendar days before commencing demonstration and training. University's Representative will review draft and return with comments.
    - a. The comments or corrections shall be incorporated into the Final O&M submittal.
    - b. Correct or revise each manual to comply with the University's Representatives comments. Submit electronic copies of each corrected manual within **[15]** calendar days of receipt of University's Representative's comments.
    - c. University's Representative will notify the **Contractor** when the edits have been accepted for incorporation into the final O&M submittal.
  3. Advance Submittals: For equipment, or component parts of equipment to be put into service during construction and operated by University, submit documents within ten (10) calendar days after equipment approval.
  4. Final O&M Submittal: After completion of instruction of University operation and maintenance personnel and final inspection, revise content of documents to include additional information deemed necessary from instruction experience of University's personnel and any changes made during construction. Submit each

manual in the final form prior to requesting inspection for Substantial Completion. The University's Representative will return comments electronically.

- a. Submit electronic copies of each manual prior to requesting training.

1.05 SPARE PARTS, EXTRA STOCK AND MAINTENANCE MATERIALS

- A. Products Required: Where called for in Contract Specifications, deliver to University's Representative, materials, etc., for use in maintenance work. Provide list of materials delivered to University's Representative, indicating date and acceptance by University's Representative.
  - 1. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual Sections to be provided to University's Representative, in addition to that required for completion of the Work.
  - 2. Products supplied shall be identical to those installed in the Work. Include quantities in original purchase from supplier to avoid variations in manufacture.
  - 3. Provide itemized list of all spare parts, materials and transmittal to the University's Representative for acceptance.
- B. Storage, maintenance: Store products with products to be installed in the Work, as specified in SECTION 016100 – PRODUCT REQUIREMENTS: Product Storage and Protection.
- C. Delivery to site: Prior to final payment, deliver and unload spare products to project site. Coordinate with University's Representative and obtain receipt. University will handle and store products.

1.06 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: Include a table of contents for each O&M and emergency, operations listed per CSI Specification number.
  - 2. List of Systems and Subsystems: Include references to operation and maintenance manuals that contain information about each system.
  - 3. List of Equipment: List equipment for each system, organized by system. For pieces of equipment not part of system, list separately.
  - 4. 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."

5. This Directory shall be submitted to the University's Representative for review and acceptance.

#### 1.07 MAINTENANCE AGREEMENTS

- A. Prior to Closeout all Maintenance Agreements required by the Contract Documents shall be assembled and submitted electronically with the Closeout Submittal Requirements.

1. Provide all Maintenance Agreements in PDF form.
  - a. Submit individual files for each Maintenance Agreement with a directory assembled by CSI division.
    - 1) Combine all project Maintenance Agreements including the directory into one PDF for record.
    - 2) Files will be formatted for printing with a footer identifying the CSI number and UC Davis Health project number.
    - 3) There will be a front cover to the file that contains all project information including the **Contractor** contact information.

#### 1.08 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 University'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.

#### 1.09 WARRANTIES AND GUARANTEES

- A. Warranties and Guarantees, general: Guarantees from subcontractors shall not limit Contractor's warranties and guarantees. Whenever possible, **Contractor** shall cause warranties of subcontractors to be made directly to University. If such warranties are made to Contractor, **Contractor** shall assign such warranties to University prior to final payment. When equipment and products, or components thereof, bear a manufacturer's warranty or guarantee that extends the time period of Contractor's warranty or guarantee, so state in the warranty or guarantee.
  - 1. Standard Product Warranties: Preprinted written warranties published by individual manufacturers for particular products and specifically endorsed by manufacturer to University.
  - 2. Special Warranties: Written warranties required by or incorporated in Contract Documents, to extend time limits provided by standard warranties or to provide greater rights for University.
  - 3. Provisions for Special Warranties: Refer to General Conditions of the Contract for terms of Contractor's special warranty of workmanship and materials.
  - 4. Specific Warranty Requirements: requirements are included in the individual Sections of Division 2 through 49 of the Contract Specifications, including content and limitations.
  - 5. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve **Contractor** of warranty on work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractor's requirement to countersign special warranties with Contractor.
  - 6. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
  - 7. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to original warranty with an equitable adjustment for depreciation.
  - 8. Replacement Cost: On determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. **Contractor** shall be responsible for cost of replacing or rebuilding defective work regardless of whether University has benefited from use of the work through part of its useful service life.



9. University Recourse: Written warranties made to the University are in addition to implied warranties, and shall not limit duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which University can enforce such other duties, obligations, rights, or remedies.
  10. Rejection of Warranties: University reserves right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
  11. University reserves right to refuse to accept work where a special warranty, or similar commitment is required, until evidence is presented that entities required to countersign commitments are willing to do so.
  12. When designated portion of Work is completed and occupied or used by separate agreement with **Contractor** during the construction period, submit properly executed warranties to University's Representative within fourteen (14) calendar days of completion of that designated portion of the Work.
  13. Submit written guarantees, in the form contained at end of this Section.
- B. Form of Warranty or Guarantee: All written warranties and guarantees, excepting manufacturers' standard printed warranties and guarantees, shall be submitted on Contractor's, subcontractor's, material supplier's, or manufacturer's own letterhead, addressed to University. Warranties and guarantees shall be submitted in duplicate and complying with the form letter following. Warranty and guarantee letters shall be signed by all responsible parties and by **Contractor** in every case, with modifications only as approved by University to suit the conditions pertaining to the warranty or guarantee.
- C. Submission requirements:
1. **Contractor** shall collect and assemble required warranties, guarantees, bonds, and service and maintenance contracts. Provide PDF electronically signed or signed and scanned copies of each. Organize documents into an orderly sequence based on the table of contents of the Project Manual CSI divisions.
  2. Table of Contents: Provide PDF electric file with links to individual warranty sections. Include the following information.
    - a. Product or Work item.
    - b. Product or work suppliers firm name, address, telephone number and name of principal.
    - c. Scope of guarantee, bond, service or maintenance agreement.
    - d. Date of beginning of guarantee, bond, service or maintenance contract.
    - e. Duration of guarantee, bond, service or maintenance contract.
    - f. Contractor's name, address, telephone number and name of principal.
    - g. Provide information for University personnel:
      - 1) Proper procedure in case of failure.
      - 2) Circumstances that might affect validity of guarantee or bond.

D. Warranty Submittal

1. Provide all warranties in PDF composite electronically indexed files.
  - a. Submit individual files for each warranty with a directory assembled by CSI division.
    - 1) Combine all project warranties including the directory into one PDF for record
    - 2) Files will be formatted for printing with a footer identifying the CSI Number and UC Davis Health Project Number.
    - 3) There will be a front cover to the file that contains the title "WARRANTY, GUARANTEE AND BOND" as well as all project information including the **Contractor** contact information. Title of Project and UC Davis Health Project Name and Number.
    - 4) Coordinate copies of each warranty to be included in operation and maintenance manuals.
    - 5) Final Submittal shall be incorporated into one PDF, bookmarked and searchable document.

- F. Time of Submittals: Submit **[60]** calendar days prior to request for final payment. When work activity is delayed materially beyond date of Substantial Completion, provide updated submittal within ten (10) calendar days after Final Completion, listing date of Final Completion as the start of the Guarantee period.

1.10 AS-BUILT DOCUMENTS

A. Definitions:

1. The terms "As-Built Documents" or "As-builts" shall mean the marked-up version of the Contract Documents prepared by Contractor to record as-built conditions, changes, and selections made during construction.

B. Preparation of data shall be done by person(s):

1. Trained and experienced in the maintenance, preparation, and submittal of As-Built Documentation.
2. Familiar with requirements of this Section.

- C. As-built Documents Content:
1. As-built Drawings and Specifications
  2. As-built Schedule
  3. Miscellaneous As-Built Submittals
- D. As-Built Drawings and Specifications: Provide a complete set of As-Built Drawings and Specifications, showing and noting every change from the Contract Set, including but not limited to:
- Changes made in response to RFI's
  - Amended Construction Documents (ACD) and related RFI's
  - Change Orders/Field Orders and related RFI's.
  - Architect's Supplemental Information (ASI) and related RFI's.
  - Changes to locations, including access panels, windows, doors, plumbing, etc.
  - Changes caused by obstructions and the obstructions notated
  - Changes made in response to inspections
  - Final dimensions
  - Deferred Submittals (see "Miscellaneous As-Built Submittals" below)
  - Shop Drawings (see "Miscellaneous As-Built Submittals" below)
  - Final product selections
1. Format Requirements:
    - a. Provide in PDF format with bookmarks. All annotations shall be neat and legible.
    - b. File naming conventions:
      - 1) Drawings: YY\_MMDD\_University's Project Number\_As-Built\_Dwgs
      - 2) Specifications: YY\_MMDD\_University's Project Number\_As-Built\_Spec
    - c. Provide text (preferably 1/4" or larger) on each drawing and on the cover of the specifications indicating the submission date, the University's Project Number, and the term "As-Built". The text shall be the same size and general location on all sheets of the drawings and care should be taken to locate the text in a place as to not obscure text or linework on the drawings.
    - d. Bookmarks: Provide bookmarks in the following format:
      - 1) Drawings: Sheet Number – Sheet Name. Do not add additional categories or disciplines.
      - 2) Specifications: The first page of each section shall be bookmarked with: Section Number – Section Name.
        - Exception: If a hyperlinked Table of Contents is provided the bookmarks may be excluded.
    - e. Supplemental sheets: When adding a supplemental sheet containing sketches or other information that describe changes to

the Contract Documents:

- 1) Provide a two-digit numerical suffix that starts with .01 and ascends for every supplemental sheet:  
Example: If the supplemental sheet contains sketches that describe changes to the hypothetical sheet "A1-01" the first supplemental sheet will be numbered "A1-01.01".
  - 2) The sheet name and number are to be similar in text size and location to the sheet being supplemented.
  - 3) Include supplemental sheets in bookmarks.
- E. As-Built Schedule: Provide As-Built schedule per SECTION 013200 CONTRACT SCHEDULES
1. Format Requirements:
    - a. Schedule to be in PDF format.
    - b. File naming conventions:
      - 1) YY\_MMDD\_ University's Project Number\_As-Built\_Schedule
- F. As-Built Shop drawings:
1. Format Requirements:
    - a. File naming convention for shop drawings:
      - 1) YY\_MMDD\_ University's Project Number\_ShopDwg\_Spec Section Number
- G. As-built Documents Submittal: Submit all As-Built Documents together after Final Completion and in accordance with SECTION 017700 CLOSEOUT PROCEDURES. Allow 10 business days for initial review and for each resubmittal.

#### 1.11 AS-BUILT PRODUCT DATA

**EDIT NOTE: PM to verify product data is required as part of close out submittal in addition to submittals collected during construction**

- 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.
  1. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  2. Format: Submit Product Data as annotated PDF electronic file Include As-Built Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

#### 1.12 AS-BUILT PRODUCT SAMPLES

**EDIT NOTE: PM to verify physical samples are required as part of close out submittal. PM to make storage arrangements if physical samples are to be submitted.**

- A. Preparation: Mark Samples to identify the material and location or use on project; indicate finish designations of materials and products, where designations are indicated on Drawings. Cross-reference Samples with corresponding Product Data submitted.
  - 1. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 1. Note related Change Orders, As-Built Specifications, and As-Built Drawings where applicable.
  - 2. Format: Submit As-Built Samples in same size and format as indicated for each sample in the specification's sections. Pack samples securely, with protective wrapping. Include As-Built Samples directory organized by Specification Section number and title.
  - 3. Each Sample will be labeled with Manufacturer, Model, Product Number, CSI Section and UC Davis Health Project Name and Number.

#### 1.13 PHOTOGRAPHS

- A. General: Prior to Closeout all photographic documentation required per 013220 Construction Progress Reporting shall be assembled and submitted with the Closeout Submittal Requirements.

#### 1.14 CONSENT OF SURETY AND FINAL CERTIFICATES

- A. General: Prior to closeout Consent of Surety and Final Certificates required by the Contract Documents shall be assembled and submitted with the Closeout Submittal Requirements.

### **PART II - PRODUCTS – Not Applicable to this Section**

### **PART III - EXECUTION**

#### 3.01 Refer to the following attachments

- A. Guarantee
- B. Report of Work Required by Warranty

**END OF SECTION 017800**

**GUARANTEE**

Project Title: \_\_\_\_\_

Project Location: \_\_\_\_\_

Project Number: \_\_\_\_\_ DATE: \_\_\_\_\_

GUARANTEE FOR \_\_\_\_\_ (the "Contract"),  
(Specification SECTION and Contract No.)  
between The Regents of the University of California ("University") and

\_\_\_\_\_  
(Name of **Contractor** or Subcontractor) ("Contractor").

hereby guarantees to University that the portion of the Work described as follows:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

which it has provided for the above referenced Project, is of good quality; free from defects; free from any liens, claims, and security interests; and has been completed in accordance with Specification SECTION \_\_\_\_\_ and the other requirements of the Contract.

The undersigned further agrees that, if at any time within \_\_\_\_\_ months after the date of the guarantee the undersigned receives notice from University that the aforesaid portion of the Work is unsatisfactory, faulty, deficient, incomplete, or not in conformance with the requirements of the Contract, the undersigned will, within 10 days after receipt of such notice, correct, repair, or replace such portion of the Work, together with any other parts of the Work and any other property which is damaged or destroyed as a result of such defective portion of the Work or the correction, repair, or replacement thereof; and that it shall diligently and continuously prosecute such correction, repair, or replacement to completion.

In the event the undersigned fails to commence such correction, repair, or replacement within 10 days after such notice, or to diligently and continuously prosecute the same to completion, the undersigned, collectively and separately, do hereby authorize University to undertake such correction, repair, or replacement at the expense of the undersigned; and **Contractor** will pay to University promptly upon demand all costs and expenses incurred by University in connection therewith.

SUBCONTRACTOR

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

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

Name of Firm: \_\_\_\_\_

**Contractor** License Classification & Number: \_\_\_\_\_

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

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

CONTRACTOR

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

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

Name of Firm: \_\_\_\_\_

**Contractor** License Classification & Number: \_\_\_\_\_

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

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





## **SECTION 018200**

### **DEMONSTRATION AND TRAINING**

#### **PART I - GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Procedures for Demonstration of Equipment Operation and Instruction of University Personnel.

##### **1.02 RELATED SECTIONS**

- A. Section 017800 – CLOSEOUT SUBMITTALS
- B. Section 018100 – PLUMBING/HVAC TESTING PROCEDURES

##### **1.03 SUBMITTALS**

- A. Submit preliminary schedule for University Representative approval, listing times and dates for demonstration of each item of equipment and each system, in writing, minimum of thirty (30) calendar days prior to activities.
- B. Submit reports and videos within (14) calendar days after completion of demonstrations and instructions. Give time and date of each training session, and hours devoted to training with a list of persons present and the corresponding video.

##### **1.04 QUALITY ASSURANCE**

- A. Equipment installed under Contract shall operate quietly and free of vibration. Adjust, repair, balance properly, or replace equipment producing objectionable noise or vibration in occupied areas of building. Provide additional brackets, bracing, etc., to prevent such noise or vibration. Systems shall operate without humming, surging or rapid cycling.
- B. University will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon time.

#### **PART II - PRODUCTS – Not Applicable to this Section**

#### **PART III - EXECUTION**

##### **3.01 PREPARATION**

- A. Verify equipment has been inspected, commissioned, and put into operation.
- B. Send approved pdf version of completed operation and maintenance manual 7 calendar days prior to training.

3.02 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of equipment and systems to University two (2) weeks prior to date of final inspection. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months of completion.
- B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance. Display on a video screen and demonstrate the use of bookmarks and searches to find information being sought.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

**END OF SECTION 018200**

## SECTION 01 91 00

### COMMISSIONING

#### PART I - GENERAL

##### 1.01 SUMMARY

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; those systems are efficient, cost effective and meet the University's Project Requirements and operational needs; that the installation is adequately documented; and that the operations staff are adequately trained. This is achieved by a full understanding of all building systems through construction, acceptance and warranty period with actual verification of performance. It also establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. The Commissioning process does not relieve responsibility of the **Contractor** to provide a finished and fully functioning Project. The **Contractor** and Subcontractors provide the quality control for installation and start-up of the building systems.
- C. The specified commissioning activities shall demonstrate compliance with the University, LEED and California Code Commissioning requirements.
- D. Commissioning is a condition of the Contract and shall not be excluded from the base bid.
- E. Commissioning requirements extend to all alternates and change orders, as well as all subcontracts and purchase orders for work under the **Contractor's** control.
- F. Related Documents:
  - 1. Division 00 Procurement and Contracting Requirements, apply to this Section.
  - 2. Drawings and general provisions of Contract, and other Division 01 Specification Sections, apply to this Section.
  - 3. Technical Divisions of the Specifications apply to this Section.

##### 1.02 DEFINITIONS

- A. Acceptance Phase: This is the phase of the project when the facility and its systems and equipment are inspected, tested, verified, and documented, and when most of the Functional Performance Testing (FPT) and final training occurs. This will generally occur after the Construction Phase is complete (i.e., start-up and checks have been accomplished). The Acceptance Phase typically begins with certification by the **Contractor** that the systems have been started in accordance with the approved protocols and the submission of the documentation of that start-up. The Acceptance Phase ends with the successful completion of all FPT and sign-off by the CA and the University.

- B. Action Item: Any issue that requires a response, completion, corrective or additional work, or any other action. Examples include a Request for Information (RFI), a work directive, a clarification request, a to-do item, an identified deficiency, or any other like item. Actions Items must be categorized as appropriate.
- C. Action List: This is a list that is maintained and updated by the CxA that includes all Action Items that relate to Cx activities.
- D. Commissioning (Cx): The process of ensuring that all building systems perform interactively according to the design intent and that the system operations are efficient and cost effective and meet the University's functional needs.
- E. Commissioning Agent (CxA): The individual retained by the University who will oversee the Cx process, develop and stipulate many of the Cx requirements (including FPTs), manage the Cx process, and ensure and verify that systems and equipment are installed, and tested to meet the University's requirements.
- F. Commissioning Coordinator (CC): The **Contractor** shall provide a Commissioning Coordinator. The CxA, the University's Representative and the CC will comprise a commissioning management team. While the CxA leads the overall commissioning process, the CC is responsible for managing contractors in their day-to-day performance of the specified commissioning work. The CC is an employee of the **Contractor** who is regularly and frequently on site. Qualifications for the Commissioning Coordinator include experience and excellent abilities to schedule, coordinate and manage subcontractors. The following tasks are some of the critical items included in the CC's scope of work:
  - 1. Integrating the specified commissioning activities into the overall contract construction schedule, updating the schedule and providing three-week look-ahead schedules showing the upcoming commissioning related activities.
  - 2. Providing all commissioning submittals to the University's Representative and CxA.
    - a. O&M Manuals per Division 017700 Close-out Procedures and 017800 Close-out Submittals
  - 3. Coordinating University training and ensuring that training is provided in accordance with the Division 017700 Close-out Procedures and the technical specifications.
  - 4. Ensuring that subcontractor and supplier review and complete the CxA provided FPT procedures and forms then submitted in accordance with the specifications. This includes providing written comments (even if no exception is taken) regarding issues pertaining to safety, equipment protection/warranty and appropriateness of the procedure for the systems as provided from all required FPT participants for each FPT.
  - 5. Coordinating development and submittal of specified flushing, cleaning and start-up procedures and ensuring that these procedures are completed, and documentation is submitted.
    - a. Providing test reports and progress reports in accordance with the 017800 Close-out Submittals, commissioning, and technical specifications.
  - 6. Managing the **Contractor** participation in the FTP process in accordance with the commissioning specifications.

7. Managing the **Contractor** participation in resolution of issues identified during pre-commissioning meetings and during the commissioning process.
  8. Ensuring that subcontractors perform preliminary testing to verify readiness for final FPT demonstrations, submitting documented verification that systems will pass functional tests with acceptable results as documented in the FPTs and coordinating the demonstration of the FPTs to the University and the CxA.
  9. Coordinating repeat FPTs that fail due to contract deficiencies until acceptable results are achieved and managing the reimbursement of the University's costs for repeated tests in accordance with the commissioning specifications.
- G. Commissioning Plan: This is a detailed document prepared and maintained by the CxA that describes the entire commissioning process.
- H. Commissioning Specifications (Cx specs): Includes the Cx specification section and Cx-related subsections of other specifications. All **Contractor** requirements relating to Cx.
- I. Commissioning Team: The parties involved in the commissioning process for any given system. The Cx Team will include a core group involved with all systems. This core group will typically include the CxA, the University's Cx coordinator, and **Contractor** CC and/or MEP Coordinator. At any given point the team may include the project manager, members of the design team, the project inspector, product representatives, and operation and maintenance personnel.
- J. **Contractor**: As used herein, **Contractor** is a general reference to the installing parties and can therefore refer to the **Contractor**, the subcontractors, or vendors as inferred by its usage.
- K. Construction Phase: Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. **Contractor** and subcontractors complete the installation complete start-up documentation, submit O&M information, establish trends, and perform other applicable requirements to get the systems started. The Construction Phase will generally end upon completed start-up and TAB of systems and equipment.
- L. Contract Documents: The documents governing the responsibilities and relationships between the parties involved in the construction of the project including, but not necessarily limited to, the agreement/contract, construction plans and drawings, specifications, addenda, and change orders.
- M. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.
- N. Functional Completion: A milestone that marks the completion of the Acceptance Phase and successful documentation of the FPTs by the CxA.

- O. Functional Performance Testing (FPT): This process verifies that the systems within the commissioning scope function in accordance with the Contract Documents, the University's design intent and the Design Team's Basis of Design. The process includes the documented testing of the systems under actual and simulated operating conditions. Functional Performance Test (FTP) procedures are detailed instructions that allow experienced system technicians to perform the FPTs with repeatable results. The repeatability of the procedures and results validate the tests. Final performance testing of systems will begin only after the **Contractor** certifies that such systems are completely installed and ready for functional testing and after the CxA has completed the subsequent installation verification process for the systems to be tested.
- P. Installation Verification Process: This process includes the on-site review of related system components for conformance to the Contract Documents. Upon receipt of the completed **Contractor's** System Readiness Manual, the CxA will conduct this review and verify system readiness for final functional testing procedures. The CxA will document issues identified during this process and assign them to the appropriate party for resolution.
- Q. MEP Coordinator: **Contractor's** staff member who is responsible for all MEP equipment and system installation, coordination, and start-up is the primary contact for the Cx Agent and shall be responsible to organize and lead the start-up and commissioning meetings, tracks response to Action Items from Cx Agent and generate minutes.
- R. Ready to Commission statement: The subcontractor's written statement, through the System Readiness Checklist (SRC), that the equipment or system described has been completely installed, started, and tested to ensure that it has met all the requirements of the contract documents and is ready for commissioning.
- S. Start-up: Refers to the quality control process whereby the **Contractor** verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the start-up checklists, energizes the device, verifies it is in proper working order and ready for dynamic testing, and completes the start-up tests.
- T. System Readiness Checklists (SRCs): These checklists are provided by the CxA and include equipment installation and start-up items specified to be performed and verified by the **Contractor**. These checklists shall be compiled along with associated start-up forms by the **Contractor** to create the **Contractor's** System Readiness Plan. They shall be completed during installation and returned to the CxA as components of the **Contractor's** System Readiness Manual prior to the final CxA installation verification and functional performance testing process.
- U. System Readiness Manual: This document includes, for each system within the commissioning scope of work, completed and signed versions of each form submitted by the **Contractor's** .
- V. System Readiness Plan: This document shall be completed by the **Contractor** and submitted to the CxA prior to the final installation verification and functional performance testing process. By submitting these completed forms, the **Contractor** signals that the relevant systems are installed, operational and will meet functional testing acceptance criteria. The System Readiness Plan is compiled by the **Contractor** and includes, for each system within the commissioning scope of work, the System Readiness Checklists provided by the CxA, followed by the associated **Contractor's** Start-up and Test Forms. The **Contractor** System Readiness Plan shall be submitted to the CxA for review and approval prior to installation of the systems.

### 1.03 REFERENCES

- A. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE):
  - 1. ASHRAE Guideline 0-2013, The Commissioning Process
  - 2. ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for The Commissioning Process.
  - 3. ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems
- B. US Green Building Counsel (USGBC), Leadership in Energy and Engineering Design (LEED):
  - 1. Reference Guide for the version of LEED pursued by project
- C. California Building Standards Code (California Code of Regulations, Title 24):
  - 1. Part 6, Building Energy Efficiency Standards for Residential and Nonresidential Buildings
  - 2. Part 11, CALGreen

### 1.04 SYSTEMS TO BE COMMISSIONED

- A. All systems and equipment identified in the contract documents as having quality assurance or acceptance testing requirements are included in SYSTEMS TO BE COMMISSIONED by reference.
- B. All systems and equipment identified in the contract documents as requiring startup are included in SYSTEMS TO BE COMMISSIONED by reference.
- C. All systems and equipment identified in the contract documents requiring training are included in SYSTEMS TO BE COMMISSIONED by reference.
- D. Commissioning shall be system based.
  - 1. Equipment and sub-assemblies are to be installed, started and tested as components of each respective system rather than as a category of equipment or by specification section.
- E. The systems to be commissioned shall include but are not limited to the following:
  - 1. Air Handling Units
  - 2. Exhaust Fans
  - 3. HTHW Heat Exchangers
  - 4. Pumps
  - 5. Fan Coils

6. Terminal Devices (VAV boxes)
7. Sump Pumps
8. Air Transfer Fans
9. Hot Water Heaters
10. Building Control System - Direct Digital Control System
11. Energy Management System
12. Workshop Airflow Control System
13. Hydronic Systems
14. Heat Exchangers
15. Automated Lighting control systems
16. Emergency generators
17. Transfer switches
18. Environmental Rooms (hot or cold)
19. Utility Meters and sub-metering system
20. VFDs
21. Power to Mechanical Systems
22. Lighting Inverter
23. Irrigation Systems
24. Window Switches related to natural ventilation control
25. Solar Photovoltaic Power Systems
26. Solar Domestic Hot Water Systems
27. Water Reuse Systems
28. VRF Systems
29. Radiant Heaters
30. Heat Recovery boxes
31. Stair Pressurization Fans
32. Irrigation systems



33. Anaerobic Digester
34. Renewable Energy Systems
35. Fire alarm / Fire Detection System.
36. Data Systems.
37. Audio/Visual Systems.
38. Intercom / Telecom Systems.
39. Miscellaneous Low Voltage Systems.
40. Pneumatic Tube System.
41. Building Envelope.
42. Other Systems as Specified.

#### 1.05 CONSTRUCTION AND ACCEPTANCE PHASE COMMISSIONING

- A. The **Contractor** will be an active participant in the construction and acceptance phase commissioning activities. The commissioning tasks and responsibilities include following:
1. Respond to requests from the CxA for interpretation/clarification of equipment selection and sequence of operation during functional performance test development.
  2. Review, and provide direction as necessary on, the functional performance tests developed by the CxA for conformance with the design intent, within an agreed time interval.
  3. Supporting the commissioning process by diligently executing the contract requirements to provide a fully functional facility ready for testing and working closely with the commissioning team to integrate the commissioning process into the project delivery schedule.
  4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  5. Cooperate with the CxA for resolution of issues recorded during the commissioning process.
  6. Schedule and attend commissioning kick-off meeting and commissioning coordination meetings.
  7. Integrate and coordinate commissioning process activities with construction schedule.
  8. Develop quality assurance process to verify and document proper installation, access, startup, adjusting, check out and maintenance of commissioned systems.

9. The CxA will develop the System Readiness Checklist (SRC) forms for each system within the commissioning scope of work. These forms summarize specific aspects of the installation of each system that the **Contractor** must verify prior to conducting functional performance testing. The SRC forms will be submitted to the **Contractor** and subcontractors for review and comments and subsequently compiled into the System Readiness Plan.

As part of the commissioning submittals, the **Contractor** shall submit a System Readiness Plan to the CxA. This document is typically a binder organized into sections with one section per system, each of which includes the SRC for that system followed by Manufacturer – or installation subcontractor-provided installation checklists, detailed start-up procedures, blank TAB forms and other project specific test forms. The CxA will review the System Readiness Plan and document any missing or erroneous forms. After the **Contractor** provides the correct forms, the CxA will provide final approval and acceptance of the System Readiness Plan for use by the **Contractor** and/or installation subcontractors. Once approved, the System Readiness Plan is subsequently referred to as the System Readiness Manual.

10. Review and accept commissioning functional performance test procedures provided by the CxA.
11. Ensure cooperation and participation of specialty subcontractors.
12. Provide to CxA a completed Functional Verification Checklist certifying that for all (listed) systems and equipment to be commissioned, that all systems, subsystems, equipment, and controls are ready for testing.
13. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
14. Execution of the Functional Performance Test protocols for CxA to witness.
15. Manage every aspect of the training program including being responsible for all training requirements. An outline of the training requirements shall be developed with the University and CxA.
16. Responsible for developing and implementing a formal equipment maintenance program to ensure that all equipment specified to be installed on the project is received and maintained in good working order until accepted by the University.

#### 1.06 SUBMITTALS

- A. The **Contractor** shall provide the CxA a list of required equipment/system submittals to the CxA. The CxA will identify submittals to be submitted to the CxA concurrent with submission to the University's Representative for review.
- B. The **Contractor** shall provide the CxA the requested submittals for the CxA concurrent review, with submission to the University for review
- C. One set of searchable and bookmarked electronic file of coordination drawings which includes all commissioned systems e.g., mechanical, electrical, fire protection, plumbing, and telecom.

- D. Names of **Contractor** and subcontractor's personnel who will be responsible for the start-up and commissioning of the facility. To include names, email, and telephone contact information.
- E. Start-up and commissioning schedule. To include detailed plan of the sequence of construction with start and completion dates for each phase.
- F. Start-up forms for equipment and systems installed in the building. Documents to be used by sub-contractors to ensure that the building complies with the requirements of the contract documents.
- G. All Subs, through the **Contractor**, shall submit required installation, start-up, and preventive maintenance equipment data sheets to the CxA within 45 calendar days of equipment acceptance by the University.
- H. All Subs, through the **Contractor**, shall submit initial O&M data for system and equipment being commissioned under this specification. Initial O&M data shall be submitted within 45 calendar days of equipment acceptance by the University, but no less than 8 weeks prior to the beginning of functional testing.
- I. The **Contractor** shall submit an electronic copy of the construction meeting minutes, updated construction schedule, RFI log, and Bulletin log to the CxA within seven (7) calendar days of each meeting or update.
- J. **Contractor** shall submit an electronic copy of training plan and training materials to the CxA for review and approval prior to providing training.
- K. Consolidated close out list with all training, Final O&M manuals, As-Built documentation and surplus stock listed by spec section. Information to be compiled from the specifications.

## PART II - PRODUCTS

### 2.01 TEST EQUIPMENT

- A. The **Contractor** shall supply all personnel and equipment for the demonstration and testing, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. **Contractor** supplied personnel must be competent with and knowledgeable of all project-specific systems, and automation hardware and software. All training documentation, O&Ms, and submittals shall be at the job site before functional testing commences.
- B. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and control systems in Division 23.

- C. Special equipment, tools and instruments (only available from vendor/Subs, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be provided by the **Contractor** and left on site, for the CxA to use during functional testing, seasonal testing, and deferred testing. The equipment, tools, and instruments will be returned to the vendor/Subs after successful conclusion of the commissioning effort.
- D. The controls contractor shall provide the CxA with temporary software license to be loaded on the CxA's computer, and any necessary network connection cables, for accessing the direct digital control system field panels for system testing. The controls contractor shall also provide a palm device (if applicable) with attachments, software, and cables, to check setpoint values of terminal device controllers. The controls contractor shall provide the CxA with log on ID, password, and LAN IP connection criteria for remote connection to direct digital control system. All the software, cables, and modems provided to the CxA will be returned at the successful conclusion of the commissioning effort.
- E. All testing equipment used by the contractors shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Document Specifications (Project Manual). If not otherwise noted, the following minimum requirements apply to test and measurement equipment: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.1°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

### PART III - EXECUTION

#### 3.01 AFTER AWARD OF CONTRACT

- A. The **Contractor** shall identify the person on their staff who will serve as the Commissioning Coordinator (CC). This person shall be responsible for all startup and commissioning issues on the project. Specific duties are identified in Part 1 of this Section.
- B. Within the first 30 calendar days of the project the **Contractor** shall meet with the University and the commissioning agent to discuss the process to be used on the project for managing communication to and from the Cx agent. This is to include the means for communication issues, commissioning reviews, processing submittals, RFIs, change orders, etc., meeting minutes, schedule information, Cx agent observations, and the action item lists. If a mutually agreeable process cannot be agreed upon, the Cx agent's process and software tools will be utilized.
- C. Within the first 60 days of the project there will be a meeting of the GC, the Cx agent and the key subcontractor's personnel to review how the Cx process will be implemented on the project and how the communication and documentation requirements will be met. The subcontractors are expected to send the staff that will be participating in the start-up and commissioning meetings.

- D. The **Contractor** will submit a schedule listing the key startup and Cx activities. The initial schedule can be general in nature. As the project progresses, the details on the schedule must be sufficient to list the activities of each **Contractor** for each phase of the project and what work must be accomplished before each listed task.
- E. The **Contractor** is to identify the team members from each subcontractor who will be participating in the start-up and commissioning meetings. This list is to include the name and contact information for the subcontractor's commissioning coordinator.
- F. The **Contractor** is to compile a listing of all factory tests that will take place prior to the start of the start-up and commissioning meetings. The consolidated list, along with an approximation of when they are expected to take place, shall be forwarded to the Cx agent.

### 3.02 Cx MEETINGS

- A. Eight weeks prior to supplying potable water to the building or the permanent power, the Commissioning Coordinator (CC) will schedule the first start-up and commissioning meeting. The meetings will not be concurrent with the **Contractor's** MEP coordination meeting and are to be scheduled at a mutually agreeable time between the **Contractor**, the Cx agent, and the University.
- B. The meetings will initially be held every second or third week as appropriate, and then increase in frequency to weekly as the bulk of the start-up and commissioning work is taking place.
- C. During each meeting an updated start-up and commissioning schedule will be distributed. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.
- D. During the meetings a consolidated training, O&M, and attic stock list drawn from the contract document requirements will be distributed. Decisions on the O&M review, when the training will take place, and how the stock will be turned over the University will be made based on this document. In addition to the hard copies distributed at the meeting, an electronic version shall be forwarded to the Cx agent and the University.
- E. Minutes of the start-up and commissioning meetings will be generated and distributed by the Commissioning Coordinator (CC). The minutes are to incorporate findings from the Cx agent. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.
- F. The updated FPTs will be provided to the **Contractor** by the Cx agent.
- G. The **Contractor** and the subcontractors will be required to coordinate their activities, and work collaboratively, with the test and balance contractor hired by the University.
- H. The **Contractor** will coordinate the schedules for two review meetings to be led by the Cx agent. The first will be a comprehensive test and balance review and needs to include the mechanical subcontractor's wet and dry side foreman. The second meeting will be a controls review. This meeting is to be attended by the controls subcontractor's lead on the project and the programmer. Each meeting is to last at least two hours.

3.03 FIELD START-UP AND TESTING

- A. The dates for all field start-up activities shall be listed on the start-up and commissioning schedule.
- B. The CxA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional checklists to be completed, during the startup process.
- C. The TAB contractor submits their TAB plan, along with the TAB Plan Review Checklist, for approval by the CxA prior to starting TAB work.
- D. In general, the checkout and performance verification proceeds from simple to complex, from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
- E. The CxA shall review shop drawings and material certifications, review of reports from independent testing agencies, independent on-site periodic construction observation and attendance of selected quality control-related meetings (e. g., Pre-installation Conferences).
- F. Pre-Functional Test Phase:
  - 1. The **Contractor** shall prepare the equipment and systems for start-up in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. Start-up shall be performed by the **Contractor's** and/or manufacturer's start-up technicians in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. The **Contractor** shall test the systems to verify that they perform in accordance with the Contract Documents, including the commissioning FPT procedures.
  - 2. The CxA will witness equipment start up and testing. The **Contractor** shall notify the CxA in writing at least fourteen (14) calendar days in advance of the start-up and testing dates so that the CxA can schedule attendance. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA. When scheduled start-up activities are not executed because of lack of preparation or coordination by the **Contractor**, the **Contractor** will be subject to back-charges in accordance with the Contract Documents.
  - 3. The **Contractor** shall complete and compile all start-up forms, test forms and SRCs for the System Readiness Manual and submit to the CxA.
  - 4. Upon receipt of the completed System Readiness Manual forms, the CxA will perform an Installation Verification by providing various inspections and back-checks of the completed System Readiness Manual forms. Issues notes during this process will be documented by the CxA in the Commissioning Issues Log.
  - 5. Upon acceptance of the System Readiness Manual, which includes the draft TAB report, functional performance testing shall be scheduled. Functional performance testing shall not commence until all critical issues identified during the Installation Verification process are resolved.

- G. Upon completion of the start-up and contractually required work, the **Contractor** shall submit a 'Ready to Commission' document to the University for the Specific Equipment and/or system that is complete. It is only after this document is received that the FPTs will commence.

3.04 Functional Performance Testing:

- A. Functional Performance Testing of commissioned systems shall begin after all critical issues discovered during the installation verification process have been corrected.
- B. The procedure for developing and performing the FPTs shall be as follows:
  - 1. The **Contractor** shall provide the equipment and commissioning submittals as specified in the Contract Documents.
  - 2. The Commissioning Authority will draft the FPT procedures based on the **Contractor's** submittals as approved by the Design Team. The draft procedures will be submitted to the Commissioning Team for review.
  - 3. Each **Contractor** and equipment supplier that is specified as an FPT participant in the FPT Summary Tables in the specifications shall participate in the development and performance of the associated FPTs. Each FPT participant shall provide written comments on the associated FPT procedures regarding each of the following issues:
    - a. Verify that the procedures can be performed without compromising the safety of the participants
    - b. Verify that the procedures can be performed without compromising the warranties of equipment, components, and systems
    - c. Verify that the procedures are appropriate for the equipment, components and systems as provided
  - 4. The CxA will complete the working drafts of the FPT procedures.
  - 5. Subcontractors and suppliers shall provide the personnel, expertise and test equipment to operate and maintain the systems during testing.
  - 6. The **Contractor** shall test all systems within the commissioning scope of work, using the FPT procedures until the acceptable results specified in the FPT procedure are verified and documented. If necessary to obtain acceptable results, the **Contractor** may consult with the CxA to acquire clarification and resolve issues. The CxA will be available for on-site assistance of this nature.
  - 7. The **Contractor** shall submit documentation that verifies that the acceptable results specified in the FPT procedures have been verified and that they are ready to demonstrate the FPTs with acceptable results. Acceptable documentation consists of completed FPT record forms which document acceptable FPT results or indication on the Systems Readiness Checklists that the **Contractor's** pre-functional testing has verified that functional performance testing of the equipment and associated system demonstrate the acceptable results as specified.

8. After the CxA has accepted the **Contractor's** documentation of acceptable results, the FPT shall be conducted and demonstrated to the CxA. If acceptable results are not demonstrated for an FPT, the **Contractor** shall resolve the issue(s) and the demonstration shall be repeated.
9. The **Contractor** shall verify and document acceptable FPT results for all equipment components and systems. The FPTs may be demonstrated for a sample of the systems that comply with all of the following criteria. This process is referred to in this document as "demonstration sampling".
  - a. There shall be many of the systems with similar components that have identical sequences of operation which are implemented using identical control software programming.
  - b. The components and systems to be included in the Demonstration Samples will be chosen by the CxA at the time of demonstration.
  - c. The sample size will be in accordance with the Functional Performance Test (FPT) Demonstration Sampling Tables in the specifications.
  - d. Acceptable results must be demonstrated for the entire sample. If the FPT results are not acceptable due to a lack of preparation or coordination by the **Contractor** for any system or component sampled, the FPT shall be demonstrated for all the systems and components for which it was written. Whenever the demonstrated results are not acceptable, the **Contractor** shall make corrections and the FPT shall be demonstrated again. The cost of back-checking FPTs with unacceptable results is not included in the Commissioning Authority's scope of work. Back-charging applies to additional back-checking required due to lack of preparation by **Contractor**.
10. The CC is responsible for scheduling and coordinating functional testing activities. The **Contractor** shall demonstrate the FPTs after they have verified that performing the FPTs will yield the documented acceptable results. The **Contractor** is subject to back-charging, as specified herein, if acceptable results are not demonstrated because of work that should have been verified during pre-demonstration testing prior to the submittal of the System Readiness Manual. Acceptable results must be obtained during a single demonstration. No more than two delays of less than 15 minutes each are acceptable for each test.
  - a. In addition to conducting the functional tests developed by the CxA, the **Contractor** shall be required to complete all start-up and testing procedures as specified elsewhere in the Contract Documents.
  - b. Where the CxA requires BMS trending, the CxA will provide a points list within the FPT form that may include both hardware (input/output) and software (virtual) points and appropriate trending intervals.
11. The **Contractor** shall provide trend data to the CxA in electronic format. As a University approved alternative, the **Contractor** can provide the CxA remote access to the BMS and provide training that will allow the CxA to directly download trend data.
12. The CxA will analyze and review the trend data and associated system performance.



3.05 Cx AGENT Functional Performance Testing (FPT)

- A. Upon receipt of the Ready to Cx statement, the Cx Agent will coordinate a time with the **Contractor** to witness the FPTs.
- B. The CxA develops specific equipment and system functional performance test procedures. The **Contractor** and manufacturer review the procedures to make sure the tests are safe for the equipment provided.
- C. The functional test procedures are executed by the **Contractors**, under the direction of, and documented by the CxA.
- D. The CxA will direct a TAB verification, with support from the TAB **Contractor**, to verify the values reported in the final TAB report.
- E. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
- F. All deficiencies noted will be tracked via the CxA issues log. The **Contractor** will be responsible for obtaining sign-off of corrected items.
  - 1. The **Contractor** is responsible for scheduling and coordinating commissioning activities. The **Contractor** shall reimburse the University for the cost of commissioning activities that must be repeated because of a lack of preparation or coordination by the **Contractor**. Reimbursable costs include CxA fees for services billed at the CxA's standard hourly rate. Activities subject to back-charging include: Repeated back-checking: Commissioning issues are documented in the Commissioning Issues Log. The **Contractor** shall submit a brief written statement describing when and how each issue has been resolved, which shall be added to the Issues Log maintained by the CxA. The CxA will back-check these issues on a one-time-per-issue basis to verify they have been resolved. If the back-checked issues that have not been resolved as reported, the associated cost of the unsuccessful back-check shall be subject to back-charging.
  - 2. Repeated installation verification: Once the **Contractor** has submitted the completed System Readiness Manual forms, the CxA will perform final installation verifications on selected systems. Discrepancies discovered will be reported in the Commissioning Issues Log. Back-checking the correction of these discrepancies shall be subject to back-charging.
  - 3. Repeated witnessing of FPT demonstrations: As specified in this section, the **Contractor** demonstrates the functional performance tests after they have verified that performing the FPTs will yield the documented acceptable results. The cost of witnessing demonstrations that do not demonstrate specified acceptance criteria shall be subject to back-charging.

### 3.06 SAMPLING

- A. As noted in the specifications, multiple identical pieces of non-life-safety or otherwise non-critical equipment will be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
- B. Sampling strategy referenced in the Specifications as the “xx% Sampling—yy% Failure Rule” is defined by the following example:
1. xx = the percent of the group of identical equipment to be included in each sample.
  2. yy = the percent of the sample that if failing, will require another sample to be tested.
- C. The example below describes a 20% Sampling—10% Failure Rule.
1. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.” If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
  2. If 10% of the units in the second sample fail, test all remaining units in the whole group. If at any point, frequent failures are occurring, and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

### 3.07 FAILURE DUE TO MANUFACTURER DEFECT:

- A. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the **Contractor**, the University, the A/E, or the CxA. In such case, the **Contractor** shall provide the University with the following:
1. Within one week of notification **Contractor** or manufacturer’s representative shall examine all other identical units making a record of the findings. The findings shall be provided to the University within two weeks of the original notice.
  2. Within two weeks of the original notification, the **Contractor** or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation. The University will determine whether a replacement of all identical units or a repair is acceptable.

3. Two examples of the proposed solution will be installed by the **Contractor** and the PM will be allowed to test the installations for up to one week, upon which the University will decide whether to accept the solution. Upon acceptance, the **Contractor** and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

### 3.08 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the University, A/E, and CxA. These tests will be conducted in the same manner as the seasonal tests as soon as possible.
- B. Seasonal Testing: During the warranty period, seasonal testing shall be completed as part of this contract. Seasonal testing is intended to test the performance of systems under full load conditions that cannot be simulated during the functional testing period. For example, it is impossible to test the heating system under full load conditions in July, so the heating system would be full load tested during the winter months. The CxA shall coordinate this activity. Tests will be executed, documented, and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and As-Builts due to the testing will be made by the **Contractor**

### 3.09 TRAINING OF UNIVERSITY PERSONNEL

- A. The **Contractor** shall be responsible for training coordination and scheduling and ultimately for ensuring that training is complete. The CxA will be responsible for overseeing and approving the adequacy of the training of University personnel for commissioned equipment.
  1. Instructor capabilities shall be commensurate with level of instruction required. Instructor qualifications shall be submitted to University and CxA for review prior to training.
  2. The specific training requirements of University personnel by Subs and vendors as directed within the specifications.
  3. Each Sub and vendor responsible for training shall submit a written training plan to the CxA for review and approval prior to training. The plan shall include the following elements:
    - a. Equipment (included in training)
    - b. Intended audience
    - c. Location of training
    - d. Objectives

- e. Subjects covered (description, duration of discussion, special methods, etc.)
  - f. Duration of training on each subject
  - g. Instructor name and qualifications for each subject
  - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
4. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA recommends approval of the training to the University.

### 3.10 COMMISSIONING ISSUES LOG:

- A. Issues identified during the commissioning process, including during site observations, pre-functional testing verification and functional testing, will be logged in the commissioning issues log. The CxA will maintain the master log. For each issue, the CxA will make a recommendation regarding who they believe is in the best position to provide the resolution. However, it is the **Contractor's** responsibility to manage issue resolution, including the determination of how the issue will be resolved and who will do the work.
- B. Each issue on the list will be classified with a "status" of either "resolved", "unresolved", or "resolved-unverified". "Resolved" issues are closed, having either been addressed by the **Contractor** and verified as corrected by the CxA or having been accepted by the University. "Resolved-unverified" issues have been reported as resolved by the **Contractor** but are not yet verified by the CxA as resolved. "Unresolved" issues have not been reported as addressed by the **Contractor**. Updated unresolved issues lists will be distributed to team in MS Word/Excel format.
- C. Material and method issues discovered during commissioning, but that pertain to **Contractor** construction shall be promptly reported to the A/E, CxA and the University's Representative.
- D. When a commissioning issue is resolved, the **Contractor** shall submit an updated list with a written response describing when and how the issue is resolved. The CxA or an applicable member of the Design Team shall then back-check the resolution of said issue. The CxA scope of work includes one back-check of issues that the **Contractor** reports as resolved. Back-charging applies to back-checking required due to lack of preparation of **Contractor**.

### 3.11 OPERATION AND MAINTENANCE MANUALS:

- A. The specific content and format requirements for the standard O&M manuals are detailed in Section 017800 Closeout Submittals. Special requirements for TAB contractor in appropriate Division 23 Sections and for the Controls contractor are found in appropriate Division 23 Sections. Electrical requirements are located in the appropriate Division 26 Sections. Refer to the specifications for additional O&M requirements.

1. System Narrative. The **Contractor** shall include in the beginning of the O&M manuals a separate section describing the systems including:
  - a. A system narrative describing the type and function of the system.
  - b. Site information, including facility description and current requirements
  - c. Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include chilled water distribution system, water system, condenser water system, heating system, supply air systems, and exhaust systems and others as designated. These shall show major pieces of equipment such as pumps, heat exchangers, humidifiers, control valves, expansion tanks, coils, service valves, etc.
- B. CxA Review and Approval. Prior to material completion, the CxA shall review the O&M manuals, documentation and redline As-Builts for systems that were commissioned and list other systems documentation that the CxA should review to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the University or A/E, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the University or A/E. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

### 3.12 CLOSE-OUT PROCESS

- A. All start-up documentation generated by the subcontractors shall be submitted to the Cx agent and the University in an electronic format.
- B. The sign-in sheets for all training sessions shall be submitted to the Cx agent and the University in electronic format.
- C. All training activities will be scheduled at mutually agreeable times between the **Contractor**, the University, and the Cx agent.

**END OF SECTION 01 91 00**

## SECTION 01 91 10

### BUILDING ENVELOPE COMMISSIONING

**NOTE:** This section should be used for **ALL** new construction and *some* renovation projects (stucco repair, etc.). Use of this section **MUST** be coordinated with Section 01 43 00 Mock-Ups.

#### PART I - GENERAL

##### 1.01 SUMMARY

- A. Building Envelope Commissioning is the overall building enclosure quality assurance process and requirements in addition to quality assurance procedures specified in individual Sections.
- B. Perform and document Building Envelope Commissioning (BECx). This Section supplements but does not supersede specific testing requirements found elsewhere in the Contract Documents. Include below-grade and above-grade construction as follows:
  - 1. Below-grade construction including foundations, foundation walls, slabs-on-grade, and basements.
  - 2. Above-grade Building Envelope including assemblies of exterior walls (sheathing, insulation, framing, interior finish), windows and glazing systems, doors and other exterior wall penetrations.
  - 3. Roof construction, including roofing system, insulation, skylights, hatches, and other roof penetrations.
  - 4. Interconnection between materials, components, and systems including flashing, expansion joints, and sealants.

Note to PM: Verify actual section numbers and titles with Design Professional, or edit Sections to meet Project Requirements

- C. Related Sections:
  - 1. Section 014100 REGULATORY REQUIREMENTS
  - 2. Section 014500 QUALITY CONTROL
  - 3. Section 017700 CLOSEOUT PROCEDURES
  - 4. Section 017800 CLOSEOUT SUBMITTALS
  - 5. Section 019100 COMMISSIONING
  - 6. Section 014300 MOCK-UPS
  - 7. Section 018200 DEMONSTRATION and TRAINING
  - 8. Section 042200 CONCRETE UNIT MASONRY
  - 9. Division 07 – All Sections
  - 10. Division 08 – All Sections
  - 11. Section 092400 PORTLOAND CEMENT PLASTER
  - 12. Section 099113 EXTERIOR PAINTING
  - 13. Section 099600 HIGH PERFORMANCE COATINGS

#### 1.02 REFERENCE STANDARDS

- A. ASHRAE Guideline 0-2005, 'The Commissioning Process'
- B. ASTM E2813-12, 'Standard Practice for Building Enclosure Commissioning'
- C. National Institute of Building Sciences 'Building Enclosure Commissioning Process BECx', Guideline 3, latest edition.

#### 1.03 QUALITY ASSURANCE

- A. The University will employ the Building Envelope Commissioning Manager (BECx)
  - 1. The BECx shall manage, coordinate and supervise the Building Envelope Commissioning activities including the following:
    - a. Coordinate submittals and requests for information with the University's Representative pertaining to this specification section.
    - b. Coordinate inspection and testing activities with the Contractor. Create a detailed testing plan which identifies when the various tests will be completed and actions to be taken if deficiencies are found.

- c. Supervise the Building Envelope commissioning process and coordinate the commissioning activities with the Contractor and the University Representative. Contractor to assign a coordinator authorized as a representative of each trade in commissioning activities.

B. Coordination Meetings:

1. The BECX shall plan and conduct coordination meetings including, University Representative, Contractor, and other required parties as construction progresses.
  - a. A kick-off meeting shall be scheduled at least 30 calendar days prior to the start of foundation installation. The objectives of the meeting are to review the building enclosure commissioning work scope, to clarify team member roles and responsibilities, and to plan the commissioning activities for the entire duration of the project.
  - b. Subsequent meetings shall be scheduled every two weeks or as needed during the completion of the building enclosure. The objective of these meetings is to facilitate coordination of the Work and resolve conflicts and deficiencies before performance testing of the Mockup and the following construction.

1.04 SUBMITTALS

- A. Building Envelope Commissioning Plan and Schedule: Contractor to provide a recommended schedule for commissioning activities and provide specific information on the date and duration of individual tests for all components that make up the building enclosure from below grade to the highest point on the building to the BECx for coordination with the Building Envelope Commissioning Plan. BECx shall review the schedule and make recommendations back to the Contractor for final insertion into the Project Schedule.
- B. The Contractor to coordinate with submittal requirements within related specification section as it pertains to this section.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Provide all materials, labor and documentation to execute the Building Envelope commissioning activities described in the Contract Documents.
- B. Coordinate the commissioning work included herein and ensure that all trades execute their responsibilities according to the Contract Documents.
- C. Include Building Envelope Commissioning and required testing and inspection activities in the contract schedule
- D. Attend commissioning meetings and provide meeting notes of those meetings.
- E. Building Envelope Commissioning Coordinator (BECC): The Contractor shall provide a Building Envelope Commissioning Coordinator. The BECX, the University's



Representative and the BECC will comprise a commissioning management team. While the BECx leads the overall commissioning process, the BECC is responsible for managing the day-to-day performance of the specified commissioning work. The BECC is an employee of the Contractor who is regularly and frequently on site and shall be responsible for only the Building Envelope portion of all Cx activities. Qualifications for the BECC include experience and excellent abilities to schedule, coordinate and manage subcontractors. The following tasks are some of the critical items included in the BECC's scope of work:

1. Integrating the specified commissioning activities into the overall contract construction schedule, updating the schedule and providing three-week look-ahead schedules showing the upcoming commissioning related activities.
2. Providing all commissioning submittals to the University's Representative.
3. Coordinating University training and ensuring that training is provided in accordance with the commissioning specifications.
4. Ensuring that subcontractor and supplier reviews of the BECx provided procedures and forms are completed and submitted in accordance with the specifications. This includes providing written comments (even if no exception is taken) regarding issues pertaining to safety, equipment protection/warranty and appropriateness of the procedure for the systems as provided from all required testing.
5. Providing test reports and progress reports in accordance with the commissioning specifications.
6. Managing the Contractor's participation in the testing process in accordance with the commissioning specifications.
7. Managing the Contractor's participation in resolution of issues identified during commissioning.
8. Ensuring that subcontractors perform preliminary testing to verify readiness for final testing, submitting documented verification that systems will pass tests with acceptable results to the University's Representative and the BECx.
9. Coordinating repeat tests that fail due to Contract deficiencies until acceptable results are achieved and managing the reimbursement of the University's costs for repeated tests in accordance with the commissioning specifications.

## 1.06 PERFORMANCE REQUIREMENTS

### F. Testing

1. Perform testing on the building during construction according to the approved Building Envelope Commissioning plan.

Note to PM: select duration below in conjunction with water intrusion consultant and coordinated with size and complexity of the project.

2. In addition to testing the Mock-up, provide for 8 hours of select testing on the building as determined and directed by University's Representative.

3. Provide reports after each test, stating the results, and recommended re-testing if necessary.
4. Submit reports to University's Representative for review.
5. Do not proceed with re-testing until University's Representative has completed its review and stated so in writing.

G. Mock-ups:

1. Reference Section 01 43 00 Mock-ups and specifications for location and specific configuration requirements.
2. All testing and retesting shall occur on the mock-ups unless otherwise allowed by the University's Representative.
3. Color choices may be incorporated into the mock-ups but shall in no way impact or delay the mock-up and testing schedule.
4. Upon approval of the mock-up, the Contractor shall be released to begin installation on the building.
5. The University's Representative shall review the building, including construction sequence and technique, for comparison to the mock-up.

H. In Place Testing:

1. Contractor can elect for any required testing or re-testing to be in place on the building only as accepted by the University Representative.
2. Coordinate in-place testing with the completion of exterior systems and prior to the closing-in of the interior of walls or ceilings related to the testing location to allow for results to be evaluated and any required correction of deficiencies complete within construction sequencing.

## 1.07 SYSTEMS PERFORMANCE TESTING

Note to PM: confirm the list of tests to include with the Design Professional, The Building Commissioning Agent and water intrusion consultant. Then, have the DP coordinate requirements with technical sections as appropriate.

- A. Make the following tests of the mock-ups in the order listed:
1. Preliminary loading at 20 psf.
  2. Air Infiltration (Static Pressure): ASTM E783- Field Measurement for Air Leakage through Installed Exterior Windows and Doors, except test pressure difference shall be 6.24 psf. Infiltration for entire assembly shall not exceed 0.1cfm/sf/min.
  3. Water Penetration (Cyclic Pressure): ASTM E 1105 - Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference. Test to full design pressure without de-rating. No water intrusion is acceptable. The definition of water intrusion includes any water visible from the finished building interior, whether or not defined as controlled.
  4. Water penetration testing of exterior wall claddings. CBC Section 1403.2. Test all claddings, following this test procedure. Test to the code prescribed minimum pressure or building design pressure, whichever is greater.
  5. Other testing as required by the specifications.
- B. The required tests for the final in-place building systems are as follows:
1. Whole building pressurization testing.
  2. Building air leakage testing:
    - a. ASTM E779: Standard Test method for Determining Air Leakage Rate by Fan Pressurization
    - b. ASTM E1827: Standard Test Method for Determining Air Tightness of Buildings Using an Orifice Blower Door
    - c. Leakage rates range from **[0.1 to 0.6 CFM 75/SF per ASHRAE] [0.3 per LEED]**
  3. Water intrusion testing for building envelope and penetrations via AAMA 501.1.
  4. Roof water intrusion tests via ASTM D5957.
  5. Envelope thermal barrier testing: infrared thermography (for use after building is completed.)

6. Thermal performance tests CAN/CGSB 149-GP-2MP
7. Air Leakage testing: ACE and/ or NEBB Standard (specify zones: whole building, window/wall sections/ building areas)
8. Adhesion pull testing per ASTM D4541-17 (for pull-off strength of coatings from metal (woods or plastic) surfaces: ASTM D7234 is for use for coatings from concrete surfaces)
9. Other testing as required by the specifications.

**PART II - PRODUCTS** – Not applicable to this section.

**PART III -EXECUTION**

3.01 QUALITY CONTROL

- A. All testing shall be witnessed by the University’s Representative, BECx, Architect and Special Inspector, as required. Notify the University’s Representative of testing schedule 48 hours in advance.
- B. Testing procedures:
  1. Contractor shall conduct tests of mock-ups and final in place building systems in the presence of the University’s Representative and the BECx. Proceed with each test as coordinated with the University Representative after Contractor notification that systems are ready, and the detailed outline of test procedure is accepted.
  2. Test protocol requires that air infiltration testing precede water tests. Should it be necessary for a water test to be performed in advance of the air test, the specimen must be allowed to completely dry before air test.
  3. The testing documentation shall be distributed and approved prior to proceeding to the next stage of envelope construction and at completion of the envelope.
  4. Test reports shall include a description of the specific building enclosure system at the time of testing, date and time of test, description of test performed, listing of testing results, and all supporting measures data along with corrective recommendations as required.
  5. If corrective work is to be performed, test shall be repeated, and a revised report submitted.

C. Corrective Measures:

1. Correct any deficiencies in the mock-up observed during testing and repeat tests as may be required to show compliance with the specified performance standards and the Contract Documents. Resubmit any submittals affected by these corrections. Resubmit Shop Drawings with changes made to assemblies to successfully complete preconstruction testing.
2. Deficiencies requiring repair or modification to the mock-up shall mandate a complete retesting of the mock-up beginning with the specified Preliminary Test unless otherwise requested by the University's Representative. If compliance with the performance standards is not achieved after 2 complete retests the Contractor shall replace mock-up completely with revised construction and start testing from the beginning.
3. Incorporate corrective measures indicated by the test report into the final exterior wall assemblies after review by the University's Representative.

D. Final Acceptance of the mock-up shall be done in writing:

1. Successful testing results and the completed test report are required for this acceptance and prior to start of work on final building systems in place.

### 3.02 BECx INSPECTIONS AND TESTING REQUIREMENTS

A. Provide all materials, labor, testing and documentation to execute the commissioning activities as described below and for elements of the building envelope as described in their individual Sections, including, but not limited to the following:

1. Water intrusion: 100% visual inspection of installed Work, performed in progress, documented by field reports, and in addition:
  - a. Below-grade construction, including foundation walls, below grade drainage and slabs-on-grade:
    - 1) Inspections performed by qualified inspector approved by waterproofing system manufacturer provided by University Representative.
  - b. Above-grade construction, including: exterior wall systems and assemblies
    - 1) Inspections performed by qualified Building Envelope Consultant provided by the University.
    - 2) Perform water penetration testing on 10% of installed fenestration, of each type (glazed window, curtain wall and sloped glazing (skylight) systems).
    - 3) Perform Stucco Wall Area Performance Testing at two additional locations as selected by the University's Representative.

- 4) Perform water penetration testing on a sample penetration within each type of enclosure system.
- c. Roofing systems:
- 1) Steep-slope and low-slope roofing
    - a) Inspections performed by Certified Registered Roofing Observer provided by the University.
  - 2) Waterproofing systems and assemblies over occupied space: outdoor plazas, planters and paving
    - a) Inspections performed by the qualified Building Envelope Consultant provided by the University.
- d. Interface conditions (flashings, expansion joints, and sealant) between each of the materials, components and systems that comprise the above and below grade Building Envelope
- 1) Inspections performed by qualified Building Envelope Commissioning Consultant provided by the University.
    - a) Other testing as required by the specifications.

### 3.03 SEASONAL / DEFERRED TESTING

- A. Provide an allowance for 8 hours' time to assist the University's Representative with seasonal or deferred functional performance testing during the warranty period.

**END OF SECTION 01 91 10**

SECTION 024120  
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.

1.2 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 deliver to Owner ready for reuse.
- 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.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 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.

1.5 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.6 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. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or video.
  - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.



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

### 3.3 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 furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015600 Construction Facilities.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.4 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 until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least one hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

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 items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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 small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. 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.

- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. 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 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

SECTION 061000  
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Wood blocking and nailers.
  2. Wood furring and grounds.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
1. Pressure preservative treatment: Provide certification by treating plant that treated materials comply with specified requirements. For water based preservative treated materials, certify that moisture content at time of shipment from treating plant was reduced to levels specified.
  2. Fire retardant treatment: Provide certification by treating plant that treated materials comply with specified requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less, with indication of "S-Dry" on grade stamp.

### 2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Treatment shall not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
  - 2. Plywood backing panels.

### 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
  - 4. Grounds.
- B. Lumber: Sound, thoroughly seasoned, well manufactured and free from warp that cannot be corrected in process of bridging or nailing.
  - 1. Use same species for members in any one assembly.
  - 2. Seasoning: Season lumber two inches and less in thickness to moisture content of 19 percent or less, with indication of "S-Dry" on grade stamp.
  - 3. Grades for framing materials: Conform to grading rules of manufacturer's association for specie of wood being used.
- C. Softwood Lumber for Concealed Locations:
  - 1. Light framing (nominal sizes 2 inches to 4 inches thick and 2 inches to 4 inches wide):
    - a. Douglas Fir/Larch or Hem/Fir; WWPA Construction or Standard.
    - b. Southern pine; SPIB Construction Standard or Stud.
  - 2. Furring, cant strips, blocking, nailers, plates, grounds: Same material as light framing except utility grade is acceptable.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

### 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing:
  - 1. Non-load-bearing steel framing: ASTM C 1002.
  - 2. Cold-formed metal framing: ASTM C 954.

3. Provide in length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on the following:
  1. Mechanical anchors in masonry: ICC-ES AC01.
  2. Mechanical anchors in concrete: ICC-ES AC58.
  3. Adhesive anchors in masonry: ICC-ES AC193.
  4. Mechanical anchors in concrete: ICC-ES AC308.
  5. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.5 METAL FRAMING ANCHORS

- A. Provide framing anchors of types and sizes indicated.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B; G185 coating designation; and not less than 0.036 inch thick.
  1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
  1. Use for exterior locations and where indicated.

## 2.6 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- L. Wood Blocking and Nailer Installation:
  - 1. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
  - 2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- M. Wood Furring Installation: Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION



SECTION 064100  
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural wood casework of the following types:
  - a. Plastic-laminate-clad architectural cabinets.
2. Wood materials.
3. Fire-retardant-treated material.
4. Cabinet hardware and accessories.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 123661 "Simulated Stone Countertops."

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Wood materials.
3. Fire-retardant-treated material.
4. Cabinet hardware and accessories.
5. Miscellaneous materials.

B. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: For architectural cabinets.

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.

D. Samples: For the following:

1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.
  - a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermally Fused Laminate (TFL) Panels: 12 by 12 inches, for each color, pattern, and surface finish.
  - a. Provide edge banding on one edge.
3. Corner Pieces:
  - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
  - b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Fabricator and Installer.
- B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A well-established and experienced fabricator, acceptable to Owner and Architect, employing skilled workers to custom-fabricate millwork, casework and other architectural woodwork similar to that required for this Project, whose Work meets or exceeds quality requirements of specified NAAWS Grade, and whose completed Work has a record of successful in-service performance.
  1. Architect reserves the right to reject woodwork fabricator if it is Architect's opinion that previous performance by fabricator has been unsatisfactory, or if any of the following will not result in required quality within time required for completion:
    - a. Shop capacity.
    - b. Experience of workers.
    - c. Equipment or supply of material.
    - d. Previous performance by manufacturer has been unsatisfactory.
- B. Installer Qualifications: A well-established installer with experience installing millwork, casework, finish carpentry work, and other custom-fabricated woodwork similar to that required for this Project, whose Work meets or exceeds quality requirements of specified NAAWS Grade, and whose completed Work has a record of successful in-service performance.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  1. Build mockups of typical architectural cabinets as shown on Drawings.
  2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

### 2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Architectural Woodwork Standards Grade: Custom.
- B. Type of Construction: Frameless.
- C. Door and Drawer-Front Style: Flush overlay.
- D. High-Pressure Decorative Laminate (PLAM-) : ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.
  - 1. Products: Design is based on products indicated on Drawings to establish a standard of quality. Equivalent products from the following manufacturers may be acceptable provided they comply with the requirements of the Contract Documents:
    - a. ABET Inc.
    - b. Formica Corporation.
    - c. Laminart LLC.
    - d. Pionite; a Panolam Industries International, Inc. brand.
    - e. Wilsonart LLC.
- E. Exposed Surfaces:
  - 1. Plastic-Laminate Grade: HGS.
  - 2. Edges: Grade HGS.
- A. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
    - a. Edges of Plastic-Laminate Shelves: PVC tape, 1 mm minimum .
  - 2. Drawer Sides and Backs: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.
- B. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

- C. Colors, Patterns, and Finishes: As indicated on Drawings.

### 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Wood Moisture Content: 5 to 10 percent.
  2. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
  2. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
  3. Softwood Plywood: DOC PS 1, medium-density overlay.
  4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

### 2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
  1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
  2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
  2. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.
  1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
  2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.

## 2.5 CABINET HARDWARE AND ACCESSORIES

### A. Acceptable Products and Manufacturers:

1. Listed products below and in Drawings establish a standard of quality.
2. Equivalent products from the following manufacturers may be acceptable provided they comply with requirements of the Contract Documents:
  - a. Accuride International Inc.
  - b. CompX International, Inc.
  - c. Grass America.
  - d. Hardware Resources.
  - e. Hettich America L.P.
  - f. Julius Blum & Co., Inc.
  - g. Knape & Vogt Manufacturing Company.

### B. Brackets for Wall-Mounted Countertops and Shelves: Provide mounting brackets as indicated on Drawings, in size and weight capacity required for use.

1. (CWKA-1) Workstation Brackets: 1/8-inch steel; 1-1/2 inch forms with multiple 1/4-inch mounting holes per side; reversible.
  - a. Sizes: As required by application.
  - b. Capacity: 1,000 pounds minimum.
  - c. Color: As selected by Architect from manufacturer's standard colors.
2. (CWKA-2) Concealed Brackets: Size as required. Finish as selected by Architect.
  - a. Basis of Design: 2.0" Concealed Brackets by A&M Hardware, Inc.
  - b. Finish: As selected by Architect from manufacturer's standard finishes
3. (CWKA-\_) Countertop Brackets: 5 mm thick steel bar with 3/4-inch steel strut, 1000 lb. capacity per pair,
  - a. Basis of Design: KV 208 550 Ultimate L-Bracket Series.
  - b. Finish: Epoxy coated, color to be selected by Architect.
4. (CWKA-3) Steel Supports for Lavatories and Workstations: Provide custom fabricated steel supports in compliance with Section 055000 "Metal Fabrications," and the following:
  - a. Steel Tubing: ASTM A501 or ASTM A500.
  - b. Steel Bar: ASTM A36.
  - c. Finish: Prefinished or shop-primed for painted finish (PT).
  - d. Sizes and Shapes: As indicated on Drawings.
5. (CWKA-4) Adjustable Shelf Brackets and Standards: Heavy-duty, 12 ga. steel, zinc-plated.
  - a. Basis of Design: Series 1752A by McMaster-Carr.
  - b. Standards: Single-slotted standard. Spacing of standards not to exceed 18 inches.
  - c. Brackets: 540 lbs capacity per pair.

### C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.

1. Basis of Design: Grass Nexis.
2. Provide 3 per leaf over 48 inches high, 2 per leaf elsewhere.
3. Closers: Provide Quiet Soft-Cushion Closers: Nexis G-Force Soft Closer.

### D. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

### E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

### F. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

1. Basis-of-Design: Magnetic Touch Latch: Sugastune; ML-120.
  - G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
  - H. Drawer Slides: Drawer Slides:
    1. Basis-of-Design: Blum 562F Tandem Plus Blumotion with T51.1700.04 locking device. Minimum 100 lb. load rating.
  - I. Door Locks: ANSI/BHMA A156.11, E07121.
  - J. Drawer Locks: ANSI/BHMA A156.11, E07041.
  - K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
  - L. Cable Passage Grommets: Provide cord grommets in diameter shown, and in color as selected by Architect.
    1. Plastic Grommet Liner and Cap: SG Series or EDP Series by Doug Mockett.
    2. Aluminum Grommet, No Cap: MG Series by Doug Mockett.
    3. Wood Grommet Cap, No Liner: WG Series by Doug Mockett.
    4. Aluminum Grommet in Solid Surface: MM Series by Doug Mockett, MM-4 satin chrome.
    5. Type: TG Series by Doug Mockett; White 95 or Black 90, as selected.
  - M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
  - N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.
- 2.6 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
  - B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
  - C. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.
    1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- 2.7 FABRICATION
- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
  - B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 079200  
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Exterior and interior sealants (SLNT).

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
1. Submit Manufacturer's certifications that products comply with specified requirements and with local regulations for VOC content.
- B. Color Samples:
1. Samples for Initial Selection: Manufacturer's color charts consisting of actual strips of cured sealants showing the full range of colors available for each product exposed to view.
  2. Samples for Verification: For each kind and color of joint sealant selected, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Schedule: Cross-reference locations and applications of SLNT indicated on Drawings with products in Part 2 of this Section. Indicate proposed product, product type and color.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Sample Warranties: For special warranties.
- C. Quality Control Submittals:
1. Product Test Reports: For each kind of joint sealant.
  2. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
  3. Statement of qualification for manufacturers and installers.
  4. Statement of compliance for compatibility of sealant with adjacent materials and coatings.
  5. Field-Adhesion-Test Reports: For each sealant application tested.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with record of successful in-service performance.
- B. Provide materials for exterior envelope from a single manufacturer.
- C. Compatibility: Verify compatibility of silicone sealant with materials in contact with sealant. Provide list of stone materials and verify that silicone sealant will not stain or damage stone work.



- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

#### 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each kind of sealant and joint substrate.
  - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
  - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
  - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi component materials.
- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Weather Conditions: Do not proceed with installation of sealant under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
  - 1. Proceed with work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.
  - 2. Wherever joint width is affected by ambient temperature variation, apply elastomeric sealant only when temperatures are in lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.
- D. Compatibility and Adhesion Testing: Ascertain sealant compatibility and adhesion with adjacent materials using laboratory testing procedures.

## PART 2 - PRODUCTS

### 2.1 SEALANT, 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. Sealant Colors: In accordance with approved sealant color schedule.
  - 1. Colors as selected by Architect from manufacturer's standard colors. Acceptance of sealant will depend on range of standard colors available for selection.
  - 2. Custom Color:

### 2.2 SILICONE SEALANT

- A. (SLNT-8) Silicone Sealant, Mildew-Resistant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  - 1. Products and Manufacturers:
    - a. Dow Corning Corporation; Dow Corning 786.
    - b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
    - c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    - d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - e. Tremco Incorporated; Tremsil 600 White.
  - 2. Applications: Interior joints as follows:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Joints subject to water and high moisture areas.

### 2.3 ACRYLIC SEALANT

- A. (SLNT-7) Acrylic Sealants: General purpose, paintable acrylic-emulsion sealant. Caulk with approximately 12-1/2 percent elongation complying with ASTM C834.
  - 1. Products and Manufacturers:
    - a. Tremco Incorporated: Acrylic Latex 834.
    - b. Pecora Corporation: AC-20.
  - 2. Location/Use:
    - a. Joints in vertical surfaces and in horizontal surfaces not subject to traffic.
    - b. Control and expansion joints on exposed interior surfaces of exterior walls.
    - c. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    - e. Other joints as indicated.
- B. Acoustic Joint Sealant: Refer to Section 092900 for acoustic sealant in gypsum board assemblies.

### 2.4 JOINT SEALANT BACKING

- A. Joint Sealant Backer Rod Manufacturers:
  - 1. Denver Foam, Backer Rod Manufacturing, Inc.
  - 2. Construction Foam Products, Nomaco Inc..

- B. 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.
- C. Sealant Backing Material: Nonstaining, sealants, primers, and other joint fillers; compatible with joint substrates; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- D. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), 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.
- E. 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.

## 2.5 PREPARATORY MATERIALS

- A. Joint Primer: Non-staining type recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive type recommended by sealant manufacturer; compatible with joint forming materials.
- C. 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.
- D. 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.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joint surfaces, backing, and anchorage of units forming sealant rabbet, and conditions under which sealant work is to be performed. Do not proceed with sealant work until unsatisfactory conditions have been corrected.

### 3.2 JOINT SURFACE PREPARATION

- A. Preparation: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
  - 1. 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.
  - 2. 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.

- B. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant.
- C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant application.
- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce dull sheen.
- E. Ensure that joint forming materials are compatible with sealant.
- F. Examine joint dimensions and size materials to achieve required width/depth ratios. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

### 3.3 SEALANT APPLICATION

- A. Installation:
  - 1. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
  - 2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
  - 3. 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.
  - 4. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 5. 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.
- B. Apply sealant in accordance with manufacturer's printed instructions. Perform work in accordance with ASTM C804.
- C. Prime or seal joint surfaces. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- D. Install sealant backer rod for liquid elastomeric sealant, except where recommended to be omitted by sealant manufacturer for application shown.
- E. Install bond breaker tape wherever required by manufacturer's recommendations to ensure that elastomeric sealant will perform properly.
- F. Employ only proven installation techniques, which will ensure that sealant will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides.
  - 1. Except as otherwise indicated, fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between horizontal surface and vertical surface, fill joint to form slight cove, so that joint will not trap moisture and dirt.
- G. Install sealant to depth as shown or, if not shown, as recommended by sealant manufacturer but within following general limitations, measured at center (thin) section of bead:

1. For sidewalks, pavements and similar joints sealed with elastomeric sealant and subject to traffic and other abrasion and indention exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8 inch deep nor less than 3/8 inch deep.
  2. For normal moving joints sealed with elastomeric sealant, but not subject to traffic, fill joint to depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/4 inch deep.
- H. Interior joints not subject to movement, these are:
1. Gypsum board to masonry joints.
  2. Gypsum board to hollow metal joints.
  3. Gypsum board to concrete joints.
- I. Do not allow sealant or compounds to overflow or flow onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough texture surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or sealant.
- J. Remove excess and spillage of sealant promptly as work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.
- K. Rope Wicks: Where wicks for weeping masonry cavity occur in sealant, cut wick flush with sealant face and do not seal wick ends.
- 3.4 PROTECTION AND CLEANING
- A. Protect joint sealers during and after curing period from contact with contaminating operations or other causes so that they are without deterioration or damage at time of Substantial Completion.
1. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.
- B. Clean off excess sealant or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION

SECTION 096513  
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Acceptable Products and Manufacturers:
  - 1. Listed products below and in Drawings establish a standard of quality.

2. Equivalent products by other manufacturers may be acceptable provided they comply with requirements of the Contract Documents:

## 2.2 THERMOSET-RUBBER BASE

- A. Basis-of-Design Product: As indicated on Drawings.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  1. Style and Location:
    - a. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside and Outside Corners: Job formed or preformed.
- G. Colors: As indicated on Drawings.

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  1. Remove adhesive and other blemishes from surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION



SECTION 096516  
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Unbacked rubber sheet flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient sheet flooring.
1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  2. Show details of special patterns.
- C. Samples: For each exposed product and for each color, texture, and pattern specified, in manufacturer's standard size, but not less than 6-by-9-inch sections.
1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.5 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. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

## 1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 UNBACKED RUBBER SHEET FLOORING

- A. Acceptable Products and Manufacturers:
  - 1. Design is based on Environcare 3.0 mm by Nora to establish a standard of quality.
  - 2. Equivalent products from the following manufacturers may be acceptable provided they comply with the requirements of the Contract Documents:
    - 3. American Biltrite.
    - 4. Flexco Corporation.
    - 5. Johnsonite; a Tarkett company.
    - 6. PRF USA Inc.
    - 7. R.C.A. Rubber; SRP Industries.
    - 8. Roppe Corporation; Roppe Holding Company.
    - 9. VPI Corporation.
- B. Product Standard: ASTM F1859.
  - 1. Type: Type I, homogeneous rubber sheet floor covering.
  - 2. Thickness: As standard with manufacturer.
- C. Wearing Surface: Smooth.
- D. Sheet Width: As standard with manufacturer.
- E. Seamless-Installation Method: Heat welded.
- F. Colors and Patterns: As indicated on Drawings.

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- C. Seamless-Installation Accessories:
  - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
    - a. Colors: As selected by Architect from manufacturer's full range to contrast with flooring.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

### 3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
  - 1. Maintain uniformity of flooring direction.
  - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
  - 3. Match edges of flooring for color shading at seams.
  - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
  - 1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION

SECTION 099000  
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of Work Included: Work of this Section includes, but is not limited to, the following:
1. Field painting and finishing of exposed surfaces of items of architectural, structural, mechanical and electrical Work, which require paint finish for protection or appearance as shown on Drawings or as specified.
  2. Surface preparation and priming of materials required to be painted, but not furnished under Work of other Sections as primed or prepared surfaces.
  3. Touch-up painting of prime coats which have become damaged or otherwise abraded or removed during construction.
- B. Description of Work Not Included: Certain items of Work shall not be included in Work of this Section unless specific reference is made to painting such items on Drawings or in Specifications. These items include:
1. Shop finished items and materials with factory-applied or integral finish.
  2. Concealed surfaces in inaccessible areas such as foundation spaces, furred areas, utility tunnels, pipe spaces and shafts.
  3. Finished metal surfaces such as anodized aluminum, stainless steel, chromium plated metal, copper, bronze and other nonferrous metals, unless otherwise indicated.
  4. Operating parts of mechanical and electrical equipment including UL and rating labels, and equipment identification, name or nomenclature plates.
  5. UL and rating labels on doors, frames, and hardware.
- C. Section includes surface preparation and the application of paint systems on interior and exterior substrates.
1. Galvanized metal.
  2. Gypsum board.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
1. Indicate VOC content.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches square.
  2. Apply coats on Samples in steps to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

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

#### 1.4 DELIVERY, STORAGE, AND HANDLING

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

#### 1.5 FIELD CONDITIONS

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

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Products and Manufacturers – Typical Coating Systems:
  1. Listed products establish a standard of quality and are manufactured by Sherwin-Williams.
  2. Equivalent products by the following manufacturers may be acceptable provided they comply with requirements of the Contract Documents.
    - a. Benjamin Moore.
    - b. Duron Inc.
- B. Acceptable Products and Manufacturers - Polyurethane Coatings:
  1. Listed products establish standard of quality and are manufactured by Tnemec Company, Inc.
  2. Equivalent products by following are acceptable:
    - a. Carboline Company.
    - b. Dupont Company.
- C. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, products listed in the Interior Painting Schedule for the paint category indicated.

#### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

#### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.



3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. Gypsum Wallboard:
  1. Sheens, General: Unless noted otherwise on Room Finish Schedule.
    - a. Walls: Eggshell
    - b. Ceilings and Soffits: Flat
    - c. Walls where indicated on Room Finish Schedule: Semi-gloss.
  2. Waterborne Zero-VOC, Low-Odor System: Zero-VOC, Low-Odor Acrylic Finish over Zero-VOC, Low-Odor Acrylic Primer - not more than 50 grams VOCs per liter, not less than 35 percent solids, ammonia free coating.
    - a. Primer: 1 coat S-W ProMar 200 Zero-VOC Interior Latex Primer, B28W2600 Series.
    - b. Finish:
      - 1) 2 coats S-W ProMar 200 Zero-VOC Interior Latex Flat, B30-2600 Series.
      - 2) 2 coats S-W ProMar 200 Zero-VOC Interior Latex Eg-Shel, B20-2600 Series.
      - 3) 2 coats S-W ProMar 200 Zero-VOC Interior Latex Semi-Gloss, B31-2600 Series.
  3. Water-Based Epoxy System, High Traffic Areas (EPT-1): Waterborne Polyamide Gloss Epoxy Finish over Latex Primer/SealerPrimer:
    - a. Primer:
      - 1) 1 Coat: S-W ProMar 200 Zero VOC Latex Primer, B28W02600 (4.0 mils wet, 1.0 mils dry).
    - b. Finish:

- 1) 2 Coats: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-311 Series.  
(5.0-12.0 mils wet, 2.0-5.0 mils dry per coat).
  - 2) 2 Coats: S-W Pro Industrial Water Based Catalyzed Epoxy Egg-Shell, B73-360 Series  
(5.0-12.0 mils wet, 2.0-5.0 mils dry per coat).
4. Wall Surfaces Under Vinyl Wall Coverings: (Primer/Sealer)
- a. Primer: 1 coat S-W Pre-Wallcovering Primer, B28W8980.

B. Non-Ferrous Metal Surfaces (Galvanized):

1. Waterborne System, Low-VOC: Waterborne Acrylic Semi-Gloss Enamel over Waterborne Metal Primer.
  - a. Primer: 1 coat S-W DTM Acrylic Primer, B66W1.
  - b. Finish:
    - 1) 2 coats S-W DTM Acrylic Coating Semi-Gloss, B66-200 Series.
    - 2) 2 coats S-W DTM Acrylic Coating Semi-Gloss, B66-100 Series.

C. Ferrous and Non-Ferrous Metal Surfaces:

1. Surfaces including, but not limited to, the following:
  - a. Hollow metal doors and frames.
  - b. Steel stairs, ladders and railings.
  - c. Prime painted hardware.
  - d. Fire extinguisher cabinet trim.
  - e. Uninsulated piping and ductwork.
  - f. Metal access panels.
  - g. Metal supports for counters, benches and shelves.
  - h. Exposed and metal fabrications.
  - i. Other exposed to view interior ferrous metals not factory finished.
2. Waterborne System: Waterborne 100% Acrylic Gloss Enamel over Waterborne Metal Primer.
  - a. Primer (Touch-up if pre-primed): 1 coat S-W Pro-Cryl Universal Primer, B66-310 Series.
  - b. Finish:
    - 1) 2 coats S-W 0 VOC Acrylic Satin, B66-660 Series
    - 2) 2 coats S-W 0 VOC Acrylic Semi-Gloss, B66-650 Series.
    - 3) 2 coats S-W 0 VOC Acrylic Gloss, B66-600 Series.
3. Waterborne Zero-VOC, Low-Odor System: Zero-VOC, Low-Odor Acrylic over Waterborne Metal Primer; not less than 35 percent solids, ammonia free coating.
  - a. VOC Requirement: Not more than 50 grams VOC's per liter,
  - b. Primer: 1 coat S-W DTM Acrylic Primer, B66W1.
  - c. Finish:
    - 1) 2 coats S-W ProMar 200 Zero-VOC Interior Latex Semi-Gloss, B31-2600 Series.
    - 2) 2 coats S-W Zero-VOC Acrylic Gloss, B66-600 Series.

### 3.6 SMOKE AND FIRE PARTITIONS

- A. Stenciling: Stencil fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions with the appropriate Hour-rating/Minute rating, i.e., "SMOKE and/or FIRE (1 HR /2 HR) – Protect All Openings," etc. as indicated on the Life Safety Plan, above ceilings on both sides of walls in letters not less than 3 inches high and with 3/8 inch wide stroke, in accordance with requirements of applicable building Code and authorities having jurisdiction.
1. Stenciling shall be located above every door and no more than fifteen feet on center.
  2. Stencil every change in direction of rated walls.
  3. Indicate the end of a rated wall with a 2-inch vertical red line with an arrow pointing to the direction of the rated wall.

END OF SECTION

SECTION 102600  
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Corner guards (WGC).
  2. Abuse-resistant wall coverings (WGS).
  3. Wall guards (WGR).

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
- C. Samples: For each type of exposed finish.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
  2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Acceptable Products and Manufacturers:
  - 1. Listed products below and in Drawings establish a standard of quality.
  - 2. Equivalent products by other manufacturers may be acceptable provided they comply with requirements of the Contract Documents.
- B. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

### 2.3 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards (WGC): Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
  - 1. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
    - a. Profile: Nominal 3-inch- long leg and 1/4-inch corner radius.
    - b. Color and Texture: As selected by Architect from manufacturer's full range.
  - 2. Continuous Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
  - 3. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

### 2.4 ABUSE-RESISTANT WALL COVERINGS

- A. Abuse-Resistant Sheet Wall Covering (WGS): Fabricated from semirigid, plastic sheet wall-covering material.
  - 1. Basis-of-Design Product: As indicated on Drawings.
  - 2. Description: Protective wall guard of semi-rigid vinyl/alloy.
    - a. Thickness: 0.040-inch nominal.
  - 3. Size: As indicated on Drawings.
  - 4. Flame resistance: ASTM E84, flame spread 25 or less.
    - a. Color: As selected by Architect from manufacturer's full color range.
  - 5. Trim and accessories: Edge and corner trim as required for a complete finished installation as approved by Architect.
  - 6. Attachment material: Adhesive as recommended by protective wall covering manufacturer.

### 2.5 WALL GUARDS

- A. Crash Rail (WGR-2): Heavy-duty, PVC-free assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.
  - 1. Basis-of-Design Product: As indicated on Drawings.
  - 2. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness.
- B. Bumper Rail (WGR-3): Standard-duty[, PVC-free] assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.
  - 1. Basis-of-Design Product: As indicated on Drawings.

## 2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.
  - 1. Verify adhesives have a VOC content of 70 g/L or less.
  - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  - 1. Provide anchoring devices and suitable locations to withstand imposed loads.

### 3.4 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 123661  
SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Solid surface material countertops.
- B. Related Requirements:
  - 1. Section 064100 Architectural Wood Casework” for countertop supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show locations and details of joints.
  - 2. Show direction of directional pattern, if any.
- C. Samples: For the following products:
  - 1. Countertop material, 12 inches square, for each type, color, and finish.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## PART 2 - PRODUCTS

### 2.1 SOLID SURFACE COUNTERTOP MATERIALS (SSF)

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
- B. Acceptable Products and Manufacturers:
  - 1. Listed products below and in Drawings establish a standard of quality.
  - 2. Equivalent products by the following manufacturers may be acceptable provided they comply with requirements of the Contract Documents:
    - a. Avonite Surfaces; a Brand of Aristech Surfaces LLC.
    - b. DuPont; DuPont de Nemours, Inc.
    - c. Formica Corporation.
    - d. LG Hausys, Ltd.
  - 3. Type: Provide Standard type unless Special Purpose type is indicated.
  - 4. Colors and Patterns: As indicated on Drawings.
- C. Fabrication:
  - 1. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
    - a. Grade: Premium.
  - 2. Countertops:
    - a. 1/2-inch- thick, solid surface material.
  - 3. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
    - a. Fabricate with loose backsplashes for field assembly.
  - 4. Joints:
    - a. Fabricate countertops in sections for joining in field.
      - 1) Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
  - 5. Cutouts and Holes:
    - a. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - b. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

### 2.2 SUBTOPS

- A. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

### 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by scre through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

SECTION 220500  
COMMON WORK RESULTS FOR PLUMBING

PART 1 - PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  1. Piping materials and installation instructions common to most piping systems.
  2. Dielectric fittings.
  3. Supports and anchorages.

1.3 BASIS-OF-DESIGN

- A. Equipment manufacturers listed on the equipment schedules are the basis-of-design. Manufacturers listed in the specification other than the basis-of design manufacture are acceptable substitutions. Equipment schedules are on the drawings. Refer to specifications for unscheduled equipment.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

1.5 SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Equipment Startup Reports.

1.7 QUALITY ASSURANCE

- A. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- C. Equipment Substitutions: Equipment of greater capacity or of greater physical size or weight may be furnished provided such proposed equipment is approved in writing. Approval will require that any necessary structural modifications are made, any connecting mechanical and electrical services are increased, and if accommodations can be made in the allocated space. No additional costs will be approved for any changes necessary to provide the larger equipment. Refer to Division 1 Section "Product Options and Substitutions."

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.9 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate plumbing equipment installation with other building components.
- E. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- F. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- G. Coordinate connection of plumbing equipment and systems with building electrical systems.

#### 1.10 GUIDELINES, CODES AND STANDARDS

- A. Refer to the most recently published edition for references to guidelines, and standards (examples: ASHRAE, NFPA, AWWA, ASTM) unless a specific edition is listed.
- B. Installation and materials shall comply with applicable national, state, and local codes and ordinances.

## PART 2 - PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Epco Sales, Incorporated

- b. Hart Industries, International, Incorporated
  - c. Watts Industries, Incorporated; Water Products Division
  - d. Zurn Industries, Incorporated; Wilkins Division
- D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Manufacturers:
    - a. Perfection Corporation.
    - b. Precision Plumbing Products, Incorporated
    - c. Sioux Chief Manufacturing Company, Incorporated
    - d. Victaulic Company of America.

## PART 3 - PART 3 EXECUTION

### 3.1 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.2 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in steel piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric nipple fittings to connect piping materials of dissimilar metals.

END OF SECTION

SECTION 220518  
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - 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. Escutcheons.
  - 2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. BrassCraft Manufacturing Co.; a Masco Company ([www.brasscraft.com](http://www.brasscraft.com))
  - 2. Dearborn Brass ([www.oatey.com](http://www.oatey.com))
  - 3. Jones Stephens Corp. ([www.jonesstephens.com](http://www.jonesstephens.com))
  - 4. Keeney Manufacturing Company (The) ([www.keeneymfg.com](http://www.keeneymfg.com))
  - 5. Mid-America Fittings, Inc. ([www.midamericafittings.com](http://www.midamericafittings.com))
  - 6. ProFlo; a Ferguson Enterprises Inc. Brand ([www.proflo.com](http://www.proflo.com))

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With chrome-plated finish and setscrew fastener.
- B. One-Piece, Cast-Brass Type: With chrome-plated finish and setscrew fastener.
- C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- D. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- E. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

PART 3 - PART 3 EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for exposed piping penetrations of walls, ceilings, and finished floors.

- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece cast brass or split-casting brass with chrome-plated finish.
    - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
    - d. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
    - e. Insulated Piping: Split-plate, stamped steel with concealed hinge chrome-plated finish.
    - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
    - g. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge.
    - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated or rough-brass finish.
    - j. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated finish.

### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons using new materials.

END OF SECTION

SECTION 220523.12  
BALL VALVES FOR PLUMBING PIPING

PART 1 - PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.
  - 1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.5 for flanges on steel valves.
  - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 5. ASME B16.18 for solder-joint connections.
  - 6. ASME B31.9 for building services piping valves.



- C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions.
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.

## 2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO Incorporated ([www.nibco.com](http://www.nibco.com))
    - b. Milwaukee Valve Company. ([www.milwaukeevalve.com](http://www.milwaukeevalve.com))
    - c. Apollo Valves; Conbraco Industries, Inc. ([www.apollovalves.com](http://www.apollovalves.com))
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 600 psig.
    - c. Body Design: Three piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded.
    - f. Seats: PTFE.
    - g. Stem: Bronze.
    - h. Ball: Chrome-plated brass.
    - i. Port: Full.

## PART 3 - PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Division 22 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

### 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
  1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

### 3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Bronze ball valves, three-piece with full port and bronze or brass trim.
- B. Pipe NPS 2-1/2 and Larger:
  1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

END OF SECTION

SECTION 220529  
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Fastener systems.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PART 2 PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

## 2.2 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.3 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.4 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - PART 3 EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
  - 1. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used.
  - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - 4. Pipes NPS 8 and Larger: Include reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

### 3.2 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.3 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel, pipe hangers and supports, metal trapeze pipe hangers, and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  6. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  2. C-Clamps (MSS Type 23): For structural shapes.
  3. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  4. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

END OF SECTION

SECTION 220553  
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - 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. Pipe labels.
  - 2. Stencils.
  - 3. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for equipment.
  - 1. Stencil Material: Fiberboard or metal.
  - 2. Stencil Paint: Exterior, gloss acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.
  - 4. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  - 1. Brady Corporation ([www.bradycorp.com](http://www.bradycorp.com))
  - 2. Emedco ([www.emedco.com](http://www.emedco.com))
  - 3. LEM Products Inc. ([www.lemproductsinc.com](http://www.lemproductsinc.com))
  - 4. Marking Services, Inc. ([www.markserv.com](http://www.markserv.com))
  - 5. Seton Identification Products ([www.seton.com](http://www.seton.com))

- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.3 STENCILS

- A. Stencils for Piping:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
    - a. Brimar Industries, Inc. ([www.pipemarker.com](http://www.pipemarker.com))
    - b. Champion America ([www.champion-america.com](http://www.champion-america.com))
    - c. Craftmark Pipe Markers ([www.craftmarkid.com](http://www.craftmarkid.com))
    - d. Marking Services, Inc. ([www.markserv.com](http://www.markserv.com))
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping, at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
  - 3. Stencil Material: Aluminum
  - 4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

## 2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  - 1. Brady Corporation ([www.bradycorp.com](http://www.bradycorp.com))
  - 2. Emedco ([www.emedco.com](http://www.emedco.com))
  - 3. LEM Products Inc. ([www.lemproductsinc.com](http://www.lemproductsinc.com))
  - 4. Marking Services, Inc. ([www.markserv.com](http://www.markserv.com))
  - 5. Seton Identification Products ([www.seton.com](http://www.seton.com))
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass beaded chain; or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.



## PART 3 - PART 3 EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. 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, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
  - 8. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Safety Green.
    - b. Letter Color: White.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Safety Green.
    - b. Letter Color: White.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
  - a. Cold Water: 1-1/2 inches round.
  - b. Hot Water: 1-1/2 inches round.
2. Valve-Tag Color:
  - a. Cold Water: Natural.
  - b. Hot Water: Natural.
3. Letter Color:
  - a. Cold Water: White.
  - b. Hot Water: White.

END OF SECTION

SECTION 220719  
PLUMBING PIPING INSULATION

PART 1 - PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Domestic recirculating hot-water piping.
  - 3. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Division 22 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PART 2 PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; a Berkshire Hathaway Company ([www.jm.com](http://www.jm.com))
    - b. Knauf Insulation ([www.knaufinsulation.us](http://www.knaufinsulation.us))
    - c. Manson Insulation Inc. ([www.imanson.com](http://www.imanson.com))
    - d. Owens Corning ([www.owenscorning.com](http://www.owenscorning.com))
  - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - b. Eagle Bridges – Marathon Industries ([www.eaglebridges.com](http://www.eaglebridges.com))
    - c. Mon-Eco Industries, Inc. ([www.mon-ecoindustries.com](http://www.mon-ecoindustries.com))
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - b. Eagle Bridges – Marathon Industries ([www.eaglebridges.com](http://www.eaglebridges.com))
    - c. Foster Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - d. Mon-Eco Industries, Inc. ([www.mon-ecoindustries.com](http://www.mon-ecoindustries.com))

- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation ([www.dowcorning.com](http://www.dowcorning.com))
    - b. Johns Manville; a Berkshire Hathaway Company ([www.jm.com](http://www.jm.com))
    - c. P.I.C. Plastics, Inc. ([www.pic-plastics.com](http://www.pic-plastics.com))
    - d. Speedline Corporation ([www.speedline.com](http://www.speedline.com))

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - b. Knauf Insulation ([www.knaufinsulation.com](http://www.knaufinsulation.com))
    - c. Vimasco Corporation ([www.vimasco.com](http://www.vimasco.com))
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.

## 2.4 SEALANTS

- A. Joint Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - b. Eagle Bridges – Marathon Industries ([www.eaglebridges.com](http://www.eaglebridges.com))
    - c. Foster Brand; H.B. Fuller Construction Products ([www.fosterproducts.com](http://www.fosterproducts.com))
    - d. Mon-Eco Industries, Inc. ([www.mon-ecoindustries.com](http://www.mon-ecoindustries.com))
    - e. Pittsburgh Corning Corporation ([www.foamglas.com](http://www.foamglas.com))
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
  - 5. Color: White or gray.

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; a Berkshire Hathaway Company ([www.jm.com](http://www.jm.com))
    - b. P.I.C. Plastics, Inc. ([www.pic-plastics.com](http://www.pic-plastics.com))
    - c. Proto Corporation ([www.protocorporation.com](http://www.protocorporation.com))

- d. Speedline Corporation ([www.speedlinepvc.com](http://www.speedlinepvc.com))
- 2. Adhesive: As recommended by jacket material manufacturer.
- 3. Color: White
- 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division ([www.averydennison.com](http://www.averydennison.com))
    - b. Compac Corporation ([www.compaccorp.com](http://www.compaccorp.com))
    - c. Ideal Tape Co., Inc. an American Biltrite Company ([www.idealtape.com](http://www.idealtape.com))
    - d. Kanuf Insulation ([www.knaufinsulation.com](http://www.knaufinsulation.com))
    - e. Venture Tape ([www.venturetape.com](http://www.venturetape.com))
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.8 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Plumberex Specialty Products, Inc. ([www.plumberex.com](http://www.plumberex.com))
    - b. Truebro ([www.truebro.com](http://www.truebro.com))
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## PART 3 - PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Testing agency labels and stamps.
  - 2. Nameplates and data plates.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Division 07 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.



6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

### 3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot, Recirculated Hot Water, and Tepid:
  1. and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: thick.
  2. and Larger: Insulation shall be the following:
    - a. Mineral-Fiber Pipe Insulation, Type I: thick.

### 3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  1. Piping located within 8 feet of the floor; less than 200 degrees F: PVC: thick.

END OF SECTION

SECTION 221116  
DOMESTIC WATER PIPING

PART 1 - 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. Aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

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

PART 2 - PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper-Tube, Extruded-Tee Connections:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. T-DRILL Industries, Inc. ([www.t-drill.com](http://www.t-drill.com))
  - 2. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.

- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. HART Industrial Unions, LLC ([www.hartindustries.com](http://www.hartindustries.com))
    - b. Matco-Norca ([www.matco-norca.com](http://www.matco-norca.com))
    - c. Watts; a Watts Water Technologies Company ([www.watts.com](http://www.watts.com))
    - d. Wilkins ([www.zurn.com](http://www.zurn.com))
    - e. Zurn Industries, LLC ([www.zurn.com](http://www.zurn.com))
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: [150 psig minimum at 180 deg F].
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Matco-Norca ([www.matco-norca.com](http://www.matco-norca.com))
    - b. Watts; a Watts Water Technologies Company ([www.watts.com](http://www.watts.com))
    - c. Wilkins ([www.zurn.com](http://www.zurn.com))
    - d. Zurn Industries, LLC ([www.zurn.com](http://www.zurn.com))
  - 2. Standard: ASSE 1079.
  - 3. Factory-fabricated, bolted, companion-flange assembly.
  - 4. Pressure Rating: [150 psig minimum at 180 deg F]
  - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc. ([www.apsonline.com](http://www.apsonline.com))
    - b. Calpico, Inc. ([www.calpiconinc.com](http://www.calpiconinc.com))
    - c. Central Plastics Company ([www.centralplastics.com](http://www.centralplastics.com))
    - d. Pipeline Seal and Insulator, Inc. ([www.gptindustries.com](http://www.gptindustries.com))
  - 2. Non-conducting materials for field assembly of companion flanges.
  - 3. Pressure Rating: 150 psig.
  - 4. Gasket: Neoprene or Phenolic.
  - 5. Bolt Sleeves: Phenolic or polyethylene.
  - 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Grinnell Mechanical Products ([www.grinnell.com](http://www.grinnell.com))
  - b. Matco-Norca ([www.matco-norca.com](http://www.matco-norca.com))
  - c. Precision Plumbing Products ([www.pppinc.net](http://www.pppinc.net))
  - d. Victaulic Company ([www.victaulic.com](http://www.victaulic.com))
2. Standard: IAPMO PS 66.
  3. Electroplated steel nipple complying with ASTM F 1545.
  4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  5. End Connections: Male threaded or grooved.
  6. Lining: Inert and noncorrosive, propylene.

## PART 3 - PART 3 EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 "Domestic Water Piping Specialties."
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install domestic water piping level without pitch and plumb.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 3 and Smaller: Use dielectric couplings, nipples, or unions.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8 inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8 inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8 inch rod.
  - 4. NPS 1-1/2: 72 inches with 3/8 inch rod
  - 5. NPS 2: 96 inches with 3/8 inch rod
  - 6. NPS 2-1/2: 108 inches with 1/2 inch rod.
- C. Install supports for vertical copper tubing every 10 feet.

- D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8 inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8 inch rod.
  - 3. NPS 2: 10 feet with 3/8 inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2 inch rod.
- E. Install supports for vertical steel piping every 15 feet.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

### 3.6 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.8 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- 2. Use purging and disinfecting procedures required in CPC 609.9 and as prescribed by the Health Authority. If methods are not prescribed follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. The procedure shall be repeated where it is shown by a bacteriological examination made by an approved agency that contamination persists in the system.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.



- B. Flanges and unions may be used for aboveground piping joints NPS 4 and larger, unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast-or wrought-copper solder-joint fittings; and soldered joints.

### 3.11 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves for piping NPS 3 and smaller.
  - 2. Hot-Water Circulation Piping, Balancing Duty: Calibrated, Memory-stop balancing valves.
  - 3. Drain Duty: Hose-end ball valves.

END OF SECTION

SECTION 221119  
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Balancing valves.
  - 4. Strainers.
  - 5. Hose bibbs.
  - 6. Drain valves.
  - 7. Water-hammer arresters.
  - 8. Trap-seal primer valves.
  - 9. Flexible connectors.
- B. Related Requirements:
  - 1. Division 22 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Division 22 "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cash Acme ([www.cashacme.com](http://www.cashacme.com))
  - b. Watts; a Watts Water Technologies Company ([www.watts.com](http://www.watts.com))
  - c. Zurn Industries, LLC ([www.zurn.com](http://www.zurn.com))
2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Arrowhead Brass Products ([www.arrowheadbrass.com](http://www.arrowheadbrass.com))
  - b. MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - c. Watts; a Watts Water Technologies Company ([www.watts.com](http://www.watts.com))
  - d. Woodford Manufacturing Company ([www.woodfordmfg.com](http://www.woodfordmfg.com))
  - e. Zurn Industries, LLC ([www.zurn.com](http://www.zurn.com))
2. Standard: ASSE 1011.
3. Body: Bronze, non-removable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

## 2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Co. ([www.amesfirewater.com](http://www.amesfirewater.com))
  - b. FEBCO ([www.febcoonline.com](http://www.febcoonline.com))
  - c. Watts; a Watts Water Technologies Company ([www.watts.com](http://www.watts.com))
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Refer to equipment schedule for capacity and characteristics.
5. Body: Bronze for NPS 2 and smaller; with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

## 2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ITT Corporation ([bellgossett.com](http://bellgossett.com))
  - b. Armstrong International, Inc. ([www.armstronginternational.com](http://www.armstronginternational.com))
2. Type: Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.

5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

## 2.6 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron [with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and] for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch
  - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch
  - c. Strainers NPS 5 and Larger: 0.125 inch.
6. Drain: Pipe plug.

## 2.7 HOSE BIBBS

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Operation for Finished Rooms: Operating key.
12. Include operating key with each operating-key hose bibb.
13. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.8 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.9 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - b. Precision Plumbing Products ([www.pppinc.net](http://www.pppinc.net))

- c. Sioux Chief Manufacturing Company, Inc. ([www.siouxchief.com](http://www.siouxchief.com))
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.10 TRAP-SEAL PRIMER DEVICE

### A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - b. Precision Plumbing Products ([www.pppinc.net](http://www.pppinc.net))
  - c. Sioux Chief Manufacturing Company, Inc. ([www.siouxchief.com](http://www.siouxchief.com))
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

### B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg. Co. ([www.jrsmith.com](http://www.jrsmith.com))
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

## 2.11 FLEXIBLE CONNECTORS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Flex-Hose Co., Inc. ([www.flexhose.com](http://www.flexhose.com))
  - b. Metraflex Company ([www.metraflex.com](http://www.metraflex.com))
  - c. Universal Metal Hose ([www.hyspan.com](http://www.hyspan.com))

### B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

### C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## PART 3 - PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install water-hammer arresters in water piping according to PDI-WH 201.

D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

### 3.2 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Calibrated balancing valves.
3. Primary, thermostatic, water mixing valves.
4. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 "Identification for Plumbing Piping and Equipment."

### 3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.4 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

END OF SECTION

SECTION 221316  
SANITARY WASTE AND VENT PIPING

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10 foot head of water.

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two weeks in advance of proposed interruption of sanitary waste service.

PART 2 - PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Tyler Pipe; a subsidiary of McWane Inc. ([www.tylerpipe.com](http://www.tylerpipe.com))

- b. AB&I Foundry ([www.abifoundry.com](http://www.abifoundry.com))
- c. ANACO-Husky. ([www.anaco-husky.com](http://www.anaco-husky.com))
- 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ANACO-Husky. ([www.anaco-husky.com](http://www.anaco-husky.com))
  - b. Clamp-All Corp ([www.normaamericasds.com](http://www.normaamericasds.com))
  - c. Mission Rubber Company, LLC; a division of MCP Industries ([www.missionrubber.com](http://www.missionrubber.com))
- 2. Standards: Factory Mutual Standard 1680, Class I.
- 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.3 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## PART 3 - PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Sanitary sewer piping more than 5 feet outside the building is specified in Division 33 "Sanitary Sewerage."
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.



- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8 bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

### 3.2 PLUMBING SPECIALTIES

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 "Sanitary Waste Piping Specialties."
- B. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 "Sanitary Waste Piping Specialties."
- C. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8 inch rod.
2. NPS 3: 60 inches with 1/2 inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8 inch rod.

- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8 inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8 inch rod.
  3. NPS 2-1/2: 108 inches with 1/2 inch rod.
  4. NPS 3 and NPS 5: 10 feet with 1/2 inch rod.
- F. Install supports for vertical copper tubing every 10 feet.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. Comply with requirements for cleanouts and drains specified in Division 22 "Sanitary Waste Piping Specialties."
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 "Identification for Plumbing Piping and Equipment."

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

### 3.8 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.
  2. Copper DWV tube, copper drainage fittings, and soldered joints.
- B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  1. Hubless, cast-iron soil pipe and fittings; standard hubless-piping couplings; and coupled joints.
  2. Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, Hard copper tube, Type L; copper pressure fittings; and soldered joints.

END OF SECTION

SECTION 221319  
SANITARY WASTE PIPING SPECIALTIES

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous sanitary drainage piping specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PART 2 PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Zurn Industries, LLC. ([www.zurn.com](http://www.zurn.com))
      - 2) Jay R. Smith Mfg. Co ([www.jrsmith.com](http://www.jrsmith.com))
      - 3) MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - 2. Standard: ASME A112.36.2M for cast iron.
  - 3. Size: Same as connected drainage piping
  - 4. Body Material: Hubless, cast-iron soil pipe test tee.
  - 5. Closure: Raised-head, brass plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Jay R. Smith Mfg. Co ([www.jrsmith.com](http://www.jrsmith.com))
    - 2) Zurn Industries, LLC. ([www.zurn.com](http://www.zurn.com))
    - 3) MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Closure: Brass plug with tapered threads.
7. Frame and Cover Material and Finish: Nickel-bronze.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg. Co ([www.jrsmith.com](http://www.jrsmith.com))
  - b. MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - c. Zurn Industries, LLC. ([www.zurn.com](http://www.zurn.com))
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Raised-head brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg. Co ([www.jrsmith.com](http://www.jrsmith.com))
  - b. MIFAB, Inc. ([www.mifab.com](http://www.mifab.com))
  - c. Zurn Industries, LLC. ([www.zurn.com](http://www.zurn.com))
2. Body Material: Gray iron.
3. Seepage Flange: Required.
4. Anchor Flange: Required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Top of Body and Strainer Finish: Nickel bronze

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

## PART 3 - PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Assemble open drain fittings and install with top of hub 2 inches above floor.
- F. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.2 CONNECTIONS

- A. Comply with requirements in Division 22 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

### 3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 226000  
MEDICAL GAS PIPING FOR HEALTHCARE FACILITIES

PART 1 - 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. Oxygen piping.
  - 2. Vacuum piping
  - 3. Valves
  - 4. Service Connections
  - 5.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For medical gas piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Medical Gas Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
  - 1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.
- C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Medical oxygen
- B. Medical vacuum

## 2.2 PIPES, TUBES, AND FITTINGS

- A. Comply with NFPA 99 for medical gas piping materials.
- B. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service; or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue for Type L tube.
- C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

## 2.3 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- B. Threaded-Joint Tape: PTFE.

## 2.4 VALVES

- A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
- B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.
  - 1. Zone-Valve Boxes:
    - a. Steel Box with Aluminum Cover:
      - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - (a) BeaconMedaes. ([www.beaconmedaes.com](http://www.beaconmedaes.com))
        - (b) Amico Corporation ([www.amico.com](http://www.amico.com))
      - 2) Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.
        - 1) Interior Finish: Factory-applied white enamel.
        - 2) Cover Plate: Aluminum or stainless steel with frangible or removable windows.
        - 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
    - b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.
      - 1) Interior Finish: Factory-applied white enamel.
      - 2) Cover Plate: Aluminum or stainless steel with frangible or removable windows.
      - 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- C. Ball Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BeaconMedaes ([beaconmedaes.com](http://beaconmedaes.com))
    - b. Amico Corporation ([www.amico.com](http://www.amico.com))
  - 2. Standard: MSS SP-110.
  - 3. Description: Three-piece body, brass or bronze.
  - 4. Pressure Rating: 300 psig minimum.
  - 5. Ball: Full-port, chrome-plated brass.
  - 6. Seats: PTFE or TFE.
  - 7. Handle: Lever type with locking device.
  - 8. Stem: Blowout proof with PTFE or TFE seal.
  - 9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions and manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.



## 2.5 MEDICAL GAS SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BeaconMedaes ([beaconmedaes.com](http://beaconmedaes.com))
  - 2. Amico Corporation ([www.amico.com](http://www.amico.com))
- B. General Requirements for Medical Gas Service Connections:
  - 1. Suitable for specific medical gas pressure and suction service listed.
  - 2. Include roughing-in assemblies, finishing assemblies, and cover plates.
  - 3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
  - 4. Recessed-type units made for concealed piping unless otherwise indicated.
- C. Roughing-in Assembly:
  - 1. Steel outlet box for recessed mounting and concealed piping.
  - 2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
  - 3. Double seals that will prevent gas leakage.
  - 4. ASTM B 819, NPS 3/8copper outlet tube brazed to valve with service marking and tube-end dust cap.
- D. Finishing Assembly:
  - 1. Brass housing with primary check valve.
  - 2. Double seals that will prevent gas leakage.
  - 3. Cover plate with gas-service label.
- E. Cover Plates: One piece, aluminum or stainless steel and permanent, color-coded, identifying label matching corresponding service.

## PART 3 - PART 3 EXECUTION

### 3.1 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:
  - 1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
  - 2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb. of chemical to 3 gal. of water.
    - a. Scrub to ensure complete cleaning.
    - b. Rinse with clean, hot water to remove cleaning solution.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Comply with NFPA 99 for installation of medical gas piping.
- C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.
- G. Install piping to permit valve servicing.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and for branch connections.
- J. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
- K. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- L. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.

### 3.3 VALVE INSTALLATION

- A. Install shutoff valve at each connection to healthcare equipment and specialties.
- B. Install check valves to maintain correct direction of gas flow from healthcare gas supplies.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Arrange valves so largest valve is lowest. Rotate valves to angle that prevents closure of cover when valve is in closed position.

### 3.4 JOINT CONSTRUCTION

- A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- B. Threaded Joints: Apply appropriate tape to external pipe threads.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Install hangers and supports for healthcare medical gas piping systems according to NFPA 99.

### 3.6 IDENTIFICATION

- A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Division 22 "Identification for Plumbing Piping and Equipment."

- B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
  - 1. Oxygen: White letters on green background or green letters on white background.

### 3.7 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
  - 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
    - a. Initial blowdown.
    - b. Initial pressure test.
    - c. Cross-connection test.
    - d. Piping purge test.
    - e. Standing pressure test for positive-pressure medical gas piping.
    - f. Standing pressure test for vacuum systems.
    - g. Repair leaks and retest until no leaks exist.
  - 3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
    - a. Standing pressure test.
    - b. [Individual-pressurization] [or] [pressure-differential] cross-connection test.
    - c. Valve test.
    - d. Master and area alarm tests.
    - e. Piping purge test.
    - f. Piping particulate test.
    - g. Piping purity test.
    - h. Final tie-in test.
    - i. Operational pressure test.
    - j. Medical gas concentration test.
    - k. Medical air purity test.
    - l. Verify correct labeling of equipment and components.
    - m. Verify medical gas supply sources.
  - 4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
    - a. Inspections performed.
    - b. Procedures, materials, and gases used.
    - c. Test methods used.
    - d. Results of tests.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- D. Prepare test and inspection reports.

### 3.8 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

### 3.9 PIPING SCHEDULE

A. Medical Gas Piping: Type L, copper tube; wrought-copper fittings; and brazed joints.

### 3.10 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION

## SECTION 230593

### TESTING, ADJUSTING, AND BALANCING FOR HVAC

#### PART 1 - 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. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Verifying that automatic control devices are functioning properly.
  - 3. Reporting results of activities and procedures specified in this Section.

##### 1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including sub mains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. NC: Noise criteria.
- E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- F. RC: Room criteria.
- G. Report Forms: Test data sheets for recording test data in logical order.
- H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- I. Test: A procedure to determine quantitative performance of systems or equipment.
- J. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.
- K. AABC: Associated Air Balance Council.
- L. TAB: Testing, adjusting, and balancing.
- M. TABB: Testing, Adjusting, and Balancing Bureau.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Sample Report Forms: Submit two sets of sample TAB report forms.
- G. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.
- H. Warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
  - 1. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. Balance agency shall be a member of Associated Air Balance Council. Subject to compliance with requirements, balance agency shall be one of the following: (no others will be considered). Balance agency shall be approved by University prior bid.
  - 1. MESA<sup>3</sup>
  - 2. RS Analysis
  - 3. Raglen System Balance
- C. Coordination of documentation and communication flow. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
  - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

#### 1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide minimum of seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

#### 1.7 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

### PART 2 - PART 2 PRODUCTS (NOT APPLICABLE)

### PART 3 - 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. Study design specifications and engineering Drawings and prepare schedule to physically inspect mechanical equipment for hydronic and air distribution systems to be tested and balanced. Contractor shall provide balance agency with one copy of Contract Drawings and specifications, mechanical equipment submittals, and change orders necessary for proper balancing of air distribution systems.
- C. Prepare test and balance schedule, test record forms, and necessary technical information about hydronic and air distribution systems for installed heating-cooling equipment.
  - 1. Provide written documentation when the above notated items have been completed, (Example Checklist provided at the end of this section.) A single page letter signed off by the Mechanical Contractor and Test and Balance Agency will suffice.
- D. Examine systems for installed 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 accessible.
- E. Examine the approved submittals for HVAC systems and equipment.

- F. 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.
- G. 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.
- H. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- I. Balance agency shall make field inspections prior to closing in portions of systems to be balanced. Agency shall verify to its satisfaction that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that agency will be able to properly balance system.
- J. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.
  - 1. Provide written documentation of the recommended items to the Architect for review.
- K. Examine test reports specified in individual system and equipment Sections.
- L. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- M. 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 values.

### 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 and prepare reports. Include, at a minimum, the following:
  - 1. General:
    - a. Permanent electrical-power wiring is complete.
    - b. Automatic temperature-control systems are operational.
    - c. Windows and doors can be closed so indicated conditions for system operations can be met.
  - 2. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with work performed as noted within documents.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Variable-frequency controllers' startup is complete and safeties are verified.
    - f. Automatic temperature-control systems are operational.
    - g. Ceilings are installed, where applicable.
    - h. 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 Total System Balance" 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, install test ports and duct access doors that comply with requirements in Division 23 "Air Duct Accessories."
  - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 "Duct Insulation," Division 23 "HVAC Equipment Insulation," and Division 23 "HVAC Piping 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. Take and report testing and balancing measurements in inch-pound (IP) 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. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts. As-built drawings of existing systems will be made available to the installing contractor and testing agency upon request.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge.
- E. Check dampers for proper position to achieve desired airflow path.
- F. Check for airflow blockages.
- G. Verify that air duct system is sealed as specified in Division 23 "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow as may be needed to perform work.
    - a. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - b. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Review Record Documents to determine adjustments to accommodate actual conditions.
  - 3. Do not make fan-speed adjustments that result in motor overload.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure airflow of submain and branch ducts.

- a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Adjust submain branch duct volume dampers for specified airflows.
  3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure inlets and outlets airflow.
  3. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
    - a. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
  4. Re-measure each inlet and outlet after they have been adjusted.
- E. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust 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. Measure and record all operating data.
  6. Record final fan-performance data as may be applicable to perform scope of work noted.

### 3.6 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 to plus 5 percent.
  2. Air Outlets and Inlets: 0 to minus 5 percent. (unless otherwise allowed in writing by engineer of record)

### 3.7 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a pre-construction report of existing airflows and 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. Submit all reports to Architect for review upon completion.
- B. Status Reports: As work progress prepare 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. Submit all reports to Architect for review upon completion.

### 3.8 FINAL REPORT

- A. General: Prepare a certified written report; 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. Manufacturers' 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.
  5. Provide air balance summary in table format for each room listing, including, at a minimum:
    - a. Room number\*
    - b. Room name\*
    - c. Room volume\*
    - d. Air handling equipment serving the room (ie AHU-2, CAV-4, etc)\*
    - e. Required air charge rate per CMC table 4A (Outside air, supply, return, and/or exhaust, as applicable.)\*
    - f. Required cfm per CMC table 4A (Outside air, supply, return, and/or exhaust, as applicable.)\*
    - g. Scheduled Supply air, exhaust air, and return air cfm9s) per project documents.\*
    - h. Actual air supply air, exhaust air, and return air cfm(s) per air balance report.
    - i. Actual air change rate (supply, return and/or exhaust, as applicable).
    - j. Actual outside air percent, cfm, and air change rate.
    - k. Pressure relationship (P, N, NR) and percentage negative or positive.
- C.        \*\* Information available within project documents.
- D. 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 coil, 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.

- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outdoor, supply, return, and exhaust airflows.
  - 2. Water flow rates.
  - 3. Duct, outlet, and inlet neck sizes.
  - 4. Pipe and valve sizes and locations.
  - 5. Terminal units.
  - 6. Balancing stations.
  - 7. Position of balancing devices.
  
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a 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 degrees F.
    - d. Duct static pressure in inches w.g.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
  
- G. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.9 VERIFICATION OF TAB REPORT

- A. Initial Verification:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
  - 2. Check the following for each system:
    - a. Measure airflow of at least 10 percent of air outlets.
    - b. Measure water flow of at least 5 percent of terminals.
    - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    - d. Verify that balancing devices are marked with final balance position.
    - e. Note deviations from the Contract Documents in the final report.
  
- B. Final Verification:
  - 1. After initial verification is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final verification be made by Architect.
  - 2. The TAB contractor's test and balance engineer shall conduct the verification in the presence of Architect or authorized representative.

3. Architect or authorized representative shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report and request a second final inspection.
7. If the second final verification also fails, Owner may contract the services of another TAB specialist to complete the testing, adjusting, and balancing in accordance with the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
8. If the second verification also fails, Owner or design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

C. Prepare test and inspection reports.

### 3.10 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

### 3.11 END OF SECTION

### 3.12

SECTION 260500  
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.
  - 3. Demolition.
  - 4. Cutting and patching for electrical construction.
  - 5. Touchup painting.
  - 6. Disposition of existing materials and equipment.
  - 7. Electric Service Outage and Energizations.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with Federal, State and/or City Code requirements.
- D. All materials shall meet the standards of the following institutes where applicable:
  - 1. National Fire Protection Association (NFPA)
  - 2. American Society of Testing Materials (ASTM)
  - 3. American National Standards Institute (ANSI)
  - 4. National Electrical Manufacturer's Association (NEMA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Section 083100 "Access Doors and Panels."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 078400 "Firestopping."
- E. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- F. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- G. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability. Document results of said testing.

#### 1.5 DRAWINGS

- A. The drawings indicate the arrangements of electrical equipment. Review architectural drawings and details for door swings, cabinets, counters and built-in equipment; conditions indicated on architectural plans shall govern. Coordinate installation of electrical equipment with structural system and mechanical equipment and access thereto. All devices, raceway, and electrical equipment in finished and/or public spaces shall be recessed or concealed unless otherwise noted.
- B. Do not scale drawings. Obtain dimensions for layout of equipment from Architectural plans and details unless indicated on Electrical plans.
- C. Bring all discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions to the immediate attention of the Architect.
- D. Equipment layout is based on one manufacturer's product or from composite dimensions from multiple manufacturers. Where equipment selected for use on the job differs from layout, coordinate space requirements and connection arrangements.

#### 1.6 EQUIPMENT REQUIRING ELECTRICAL SERVICE

- A. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service.
- B. Drawings indicate design loads, voltages and corresponding control equipment, feeders, and overcurrent devices. If equipment actually furnished have loads other than those indicated on the drawings or specified herein, control equipment, feeders, and overcurrent devices shall be adjusted in size accordingly at no additional cost to the owner. Such adjustment shall be subject to the review of the Architect.
- C. Incidental items not indicated on Drawing or mentioned in Specifications but that can legitimately and reasonably be inferred to belong to the Work or be necessary in good practice to provide complete system, shall be furnished and installed though not itemized here in detail.

## 1.7 MECHANICAL SYSTEMS INTERFACE

- A. All control wiring for plumbing, heating, ventilating and air conditioning systems shall be installed under Division 23. Review Division 23 specifications and shop drawings for control systems to assure compatibility between equipment furnished under Division 23 and wiring furnished under Division 26.
- B. Power wiring to all motors, motor controllers and between motors and controllers shall be provided in Division 26.
- C. All electric heating equipment shall be provided and installed under Division 23 - HEATING, VENTILATING AND AIR CONDITIONING. Power wiring to all electric heating equipment shall be provided under Division 26 of these specifications.

## 1.8 SITE INVESTIGATION

- A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions which may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems shall be restored to their original condition, with the exception of the work under this contract, before the completion of this project. Existing systems and conditions which are not detailed on the drawings must still be restored to their original condition.

## 1.9 EQUIVALENTS AND SUBSTITUTIONS

- A. The applicable paragraphs for General Requirements, Division 01 apply herein.
- B. Basis of Design: The manufacturer's name and product listed on the drawings, or listed first of several names in these Specifications, is used as a basis for design to establish space requirements, a standard of quality and performance.
- C. Equivalents: Products of one or more other manufacturer's names listed in these Specifications following the words "or equivalent by" may be selected, subject to paragraph below titled "Contractor's Responsibility for Equivalent and Substitutions".
- D. Other Options:
  - 1. For products specified by naming only one manufacturer, refer to paragraph below under "Substitutions".
  - 2. For products specified only by performance characteristics or reference standards, select any manufacturer meeting the requirements.
- E. Substitutions: Requests for acceptance of a product of manufacturer's name not listed in these Specifications will be considered if any one of the following conditions is met:
  - 1. The named product is not available because of strikes or discontinuance of manufacture; and the proposed product is equivalent to the named product.
  - 2. The proposed product is superior to the named product, in the opinion of the Owner's Representative.
  - 3. The proposed product is equivalent to the named product and its use will be to the advantage of the Owner, by the Owner receiving an equitable credit or cost savings. The Owner's Representative reserves the right to reject any substitution.
  - 4. Submit proposed substitutions with bid along with alternate price, complete descriptive data and a comparison of the substitute manufacturer's product with specified product. Request for acceptance of a product of manufacturer's name not listed in these Specifications, is subject to the paragraph titled "Contractor's Responsibility Equivalents and Substitutions".
- F. Contractor's Responsibility for Equivalents and Substitutions:



1. Items submitted as a substitution to the Basis of Design or listed general equivalents shall be identified as such and shall include a written request for substitution indicating the following:
  - a. Contract Price adjustment.
  - b. Contract time adjustment.
  - c. Item by item breakdown of differences between Basis of Design and substituted item.
  - d. Operation, maintenance and energy cost difference.
2. Products of manufacturer must match the features, construction, performance and size of those selected for design. Standard catalogued may require certain modifications to meet specified requirements.
3. The responsibility for providing that specified requirements have been met remains with the manufacturer and Contractor. Should the substituted item fail to perform in accordance with the Specifications, replace same with the originally specified item without extra cost to the contract.
4. When requesting review of an equivalent or substituted product, submit a comparison chart listing features, construction, performance and sizes of name product versus equivalent or substituted product.
5. Submittals for review of an equivalent or substituted product will be reviewed for acceptability when all the above requirements have been met. Contractor shall be responsible for all costs incurred by the Architect and Engineer for review of equivalency beyond initial review.
6. Coordinate the installation of the product with all trades.
7. Contractor shall be responsible for changes in electric wiring, materials and for all other additional costs of construction by all trades involved to accommodate the product to perform the same as the product used in the "Basis of Design".
8. Coordination of General Equivalents and Substitutions: Where Contract Documents permits selection from general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with other work.
9. Provide necessary additional items so that selected or substituted item operates equivalent to the Basis of Design and properly fits in the available space allocated for the Basis of Design.
10. Contractor is responsible for assuring that piping, conduit, duct, flue and other service locations for general equivalents or substitutions do not cause access, service or operational difficulties any greater than would be encountered with the Basis of Design.
11. Failure to comply with these requirements will result in immediate rejection of the request for substitution.

#### 1.10 GENERAL SUBMITTAL REQUIREMENTS

##### A. REFER TO DIVISION 01 FOR ADDITIONAL REQUIREMENTS.

##### B. COORDINATION and Sequencing:

1. Coordinate submittals 3 weeks (minimum) prior to expected order date so that work will not be delayed by submittals.
2. Do not submit product data, or allow its use on the project until compliance with requirement of Contract Documents has been confirmed by Contractor.
3. Submittal is for information and record, unless otherwise indicated, and is not a change order request.
4. Submitting contractor is responsible for routing reviewed submittals to all parties affected including but not limited to electrical, building automation and temperature control, and test and balance subcontractors.
5. Make submittals for group of similar products or materials or by area of work complete and at one time, not in piecemeal fashion.
6. Identify submittals with Architect's project name and number, with item designation as indicated on drawings, and referenced to applicable paragraphs of the specifications. Submit in brochure form.
7. Submittals of products needed to start of Project for its installation, or those requiring a long lead time for assembly or manufacturing, should be submitted before the others.

C. Preparations of Submittals:

1. Refer to Division 01 requirements.
2. Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, Supplier, submittal name and similar information to distinguish it from other submittals.
3. Indicate any portions of work, which deviate from the Contract Documents.
  - a. Explain the reasons for the deviations.
  - b. Show how such deviations coordinate with interfacing portions of other work.
4. Show Contractor's executed review and approval marking.
5. Provide space for the Owner's Representative "Action" marking.
6. Submittals, which are received from sources other than through Contractor's office, will be returned "Without Action".
7. Submittals shall be presented in a neat and legible fashion and shall be returned "Without Action" if presented in any other fashion.

D. Response to Submittals: Where standard product data has been submitted, it is recognized:

1. That the Submitter has determined that the products fulfill the specified requirements.
2. That the submittal is for the Owner's Representative information only, but will be returned with appropriate action where observed to be not in compliance with the requirements.

E. If more than two submittals (either for shop drawings, or test reports) are made by the Contractor due to the incompleteness, non-compliance, errors, omissions, etc., the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.

1.11 RECORD DRAWINGS

A. Record drawings shall meet all "As-built" and "Record Drawings" requirements for Renown Health. Coordinate all requirements with Renown Health staff prior to completion.

B. Drawings:

1. Record of Project Progress: Maintain drawings available at the job site for inspection. Keep an accurate, legible and continuously updated record of installed locations and all project revisions other than revised drawings issued by the Architect, including source and date of authorization. Utilize only contract drawing symbols for recording the work. Drawing notations to be sufficiently clear in the representation of the work, for utilization by a CADD operator (drafts person) who is not necessarily familiar with the installed work.
2. Record of Installation: At the conclusion of the work, deliver one (1) set of updated drawings to the Owner's Representative for review. Following the review, Contractor shall have incorporated by a competent CADD operator all of the installed data represented on the project progress drawings.
3. Include in Record Drawings the Following:
  - a. Revisions, including sketches, bulletins, change orders, written addenda and directives, clarifications and responses generated by requests for information (RFIs), regardless of source of the revision.
  - b. Location and configuration of equipment with related housekeeping pads.
  - c. Physical routing of ductbank work, raceways, exposed and above ceilings with locations of fire dampers, combination fire/smoke dampers, smoke detectors, power supplies, etc., plainly marked and identified.
  - d. Location of room controllers, switches, devices, and sensors.
  - e. Physical routing of raceways, underground, exposed and above ceiling with locations of accessories, pull points, access points plainly marked and identified.
  - f. Location of raceways below building and on exterior, accessories, manholes, appurtenances and stub outs dimensioned from buildings and permanent structures, both horizontally and vertically.

- g. Location of wall and ceiling access panels.

## PART 2 - PRODUCTS

NOT USED

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

### 3.2 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 078400 "Firestopping."

### 3.3 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Reroute circuits as required to serve equipment not in the demolition area.
- C. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- D. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- E. Remove demolished material from Project site.
- F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

- G. Remove devices on wall or ceilings being removed. Coordinate with other divisions.
- H. Assume that all existing equipment and fixtures indicated to be reused are in good working condition and can be installed without repairs. Notify the Architect of items found to be in need of repair or in unusable condition for direction or decision. Repair any damage to equipment caused in removal or handling
- I. Fixtures and other equipment removed and to be-used shall be cleaned before reinstallation. Provide new lamps for reused light fixtures.
- J. Added Circuits: All loads and circuits added to existing panelboards shall be balanced between phases. On existing panelboards where circuits are changed, replace panel directories with new typed directories.
- K. All material and equipment which is noted or required by the owner to be salvaged and which is not scheduled to be reused or relocated shall be carefully removed and shall be delivered to the owner and stored where directed on the site.
- L. Remove all abandoned low voltage wiring. All wiring disconnected on one or both ends is considered abandoned unless tagged and labeled "future" or "spare". Verify with Owner any cabling connected on both ends is still in use prior to removal.

#### 3.4 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

#### 3.5 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Firestopping.
  - 2. Electrical demolition.
  - 3. Cutting and patching for electrical construction.
  - 4. Touchup painting.

#### 3.6 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 099000 "Painting."
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

#### 3.7 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

3.8 PROTECT EQUIPMENT AND INSTALLATIONS AND MAINTAIN CONDITIONS TO ENSURE THAT COATINGS, FINISHES, AND CABINETS ARE WITHOUT DAMAGE OR DETERIORATION AT TIME OF SUBSTANTIAL COMPLETION. DISPOSITION OF EXISTING BALLASTS CONTAINING PCBs

- A. Environmental Protection Agency (EPA) Regulations require controlled disposal of fluorescent light ballasts containing polychlorinated biphenyls (PCBs) when removed from service. The ballasts involved were generally manufactured between 1950 and 1979.
- B. Provide suitable ballast collection containers at the project site. Check the ballasts in all fluorescent fixtures removed from service under this contract. Some ballasts may be labeled to indicate whether they do or do not contain PCBs. Remove from the fixtures all ballasts known or assumed to contain PCBs and place them in the designated ballast collection container and arrange for the disposal of the ballasts off the site in manner approved by the EPA.
- C. Bear all cost for ballast recycling.

3.9 DISPOSITION OF EXISTING FLUORESCENT LAMPS

- A. EPA Regulations require the controlled disposal of fluorescent lamps.
- B. Remove all existing fluorescent lamps and package to prevent breakage according to EPA Regulations. Ship the lamps to a licensed lamp recycling facility with an approved material handler.
- C. Furnish the Owner with a Certificate of Disposal for these lamps, indicating the number of lamps, time and location of disposal.
- D. Bear all cost for lamp recycling.

3.10 ELECTRIC SERVICE OUTAGE AND ENERGIZATIONS

- A. Owner Approval: Electric service outages or energizations required shall be approved by the Owner before outages or energization. Outages shall be scheduled at the convenience of the Owner.
- B. Written Request: Requests for outages and energizations shall be submitted in writing to the Owner for approval at the earliest possible date and in no case later than 14 days prior to the outage and/or energization.
- C. Cancellation: The Owner reserves the right to cancel or change the scheduling of any outage up to 24 hours before its approved starting time. There shall be no additional cost to Owner for scheduled outages, or for outages re-scheduled at the Owner's request where at least 24 hours' notice has been given by the Owner.
- D. Schedules: A minimum of two (2) weeks before the first outage, submit a schedule of proposed sequence of all the electric feeder and switchboard outages and energizations. This schedule shall show construction energizations and shall include any weekend work. The schedule shall list the work to be completed during and between each outage.
- E. Minimize all outages on the Owner's electrical system and employ sufficient workmen so that work will be carried on concurrently at more than one location, when necessary.
- F. Before submitting any energization and/or outage requests, provide the owner with evidence that the following requirements have been met:
  - 1. All required equipment and material is on the job site. All related installations that can be worked on without an energization and/or outage are complete, tested, available for inspection, and ready for service.

2. All shop drawings, test reports, installation data, and operational data have been submitted and approved.
  3. The energizing and outage schedule has been submitted and approved.
- G. Similar outage procedures shall be followed for telecommunications and other services to the facility.

END OF SECTION

SECTION 260519  
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Metal-clad cable, Type MC, rated 600 V or less.
  - 3. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alanwire
  - 2. Alpha Wire.
  - 3. American Bare Conductor
  - 4. Belden Inc.
  - 5. Cerro Wire
  - 6. Encore Wire Corporation.

7. General Cable Technologies Corporation.
8. Okonite Company (The)
9. Service Wire Co.
10. Southwire Incorporated.
11. United Copper Industries.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

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

1. AFC Cable Systems.
2. Allied.
3. Anixter
4. Kaf-Tech
5. Service Wire Co.
6. Southwire Incorporated.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

H. Sheath: Steel, interlocked.

I. Jacket: PVC applied over sheath.



## 2.3 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. 3M Electrical Products
  - 2. AFC Cable Systems, Inc.
  - 3. Gardner Bender.
  - 4. Hubbell Power Systems, Inc.
  - 5. Ideal Industries, Inc.
  - 6. ILSCO
  - 7. NSi Industries LLC.
  - 8. O-Z/Gedney; a brand of the EGS Electrical Group.
  - 9. Service Wire Co.
  - 10. TE Connectivity Ltd.
  - 11. Thomas & Betts Corporation
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper.
  - 2. Type: One hole with standard barrels.
  - 3. Termination: Compression.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.
- B. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN/THWN-2, single conductors in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Group conductors with phases A, B, C, and neutral together in all conduits or raceways regardless of number of sets of conductors, conduits or raceway type.
- H. Do not install more conductors in a raceway than indicated on the drawings. A maximum of three branch circuits are to be installed in any one conduit, on 3 phase 4 wire system, unless specifically indicated otherwise on the drawings. No two branch circuits of the same phase are to be installed in the same conduit, unless specifically indicated on the drawings. Where the quantity of wires is not indicated on the drawings for branch circuits (2) #12 copper conductors shall be provided.
- I. Multipole circuit breakers shall not be used to feed multi-wire branch circuits – each circuit shall have separate and continuous neutral.
- J. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall not be less than indicated on the drawings. This sizing requirement applies to all cables in these size ranges, including those with higher insulation ratings. Use No. 10 AWG for conductors in 120 volt 20 amp branch circuits longer than 100 feet (30 m), and in 277 volt 20 amp branch circuits longer than 200 feet (60 m).
- K. Do not use MC for homeruns. Use conduit from last box in wall or ceiling back to panel.
- L. Splicing feeder conductors in a new installation is not allowed.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Stranded conductors shall have termination device crimped onto conductors prior to connection to outlet devices or installed with back-wired devices listed for stranded.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078400 "Firestopping."

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test branch circuit conductors for compliance with requirements.
  - 2. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
  - 3. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  - 4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 260526  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Conductors
  - 2. Connectors
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017800 "Closeout Submittals," include the following:
    - a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
      - 1) Conductors.
      - 2) Connectors

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M
  2. Alanwire
  3. Burndy
  4. Cerrowire
  5. Erico
  6. Galvan Electrical
  7. General Cable Technologies Corporation.
  8. Harger
  9. Hilti
  10. Hubbell
  11. IIsco
  12. Lyncole
  13. Panduit
  14. Southwire Incorporated.
  15. Thomas & Betts
  16. United Copper Industries.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Straps: Solid copper, copper lugs. Rated for 600 A.
- H. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.
- I. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use irreversible compression or exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
  - D. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
    - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
    - 2. Make connections with clean, bare metal at points of contact.
    - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
    - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
    - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- 3.4 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - B. Perform tests and inspections.
  - C. Tests and Inspections:
    - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
    - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - D. Grounding system will be considered defective if it does not pass tests and inspections.
  - E. Prepare test and inspection reports.
  - F. Report measured ground resistances that exceed the following values:
    - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  - G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Steel slotted support systems.
  - 2. Conduit and cable support devices.
  - 3. Support for conductors in vertical conduit.
  - 4. Structural steel for fabricated supports and restraints.
  - 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
  - 6. Fabricated metal equipment support assemblies.

1.3 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 the following:
    - a. Slotted support systems, hardware, and accessories.
    - b. Clamps.
    - c. Hangers.
    - d. Sockets.
    - e. Eye nuts.
    - f. Fasteners.
    - g. Anchors.
    - h. Saddles.
    - i. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Hangers. Include product data for components.
  - 2. Slotted support systems.
  - 3. Equipment supports.
  - 4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
  - 1. Include design calculations and details of trapeze hangers.
  - 2. Include design calculations for seismic restraints.



#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Ductwork, piping, fittings, and supports.
  - 3. Structural members to which hangers and supports will be attached.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Items penetrating finished ceiling, including the following:
    - a. Luminaires.
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.2/D1.2M.

#### 1.6 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014500 "Quality Control," to design hanger and support system.
- 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 Rating: Class 1.
  - 2. Self-extinguishing according to ASTM D 635.

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

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.

- d. GS Metals Corp.
  - e. Power-Strut
  - f. Thomas & Betts Corporation.
  - g. Unistrut; Tyco International, Ltd.
  - h. Wesanco, Inc.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel.
  4. Channel Width: Selected for applicable load criteria.
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 101
- B. Comply with requirements in Section 078400 "Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 2. To Existing Concrete: Expansion anchor fasteners.

3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
4. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, disconnect switches, control enclosures, pull and junction boxes, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Touchup: Comply with requirements in Section 099000 "Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533  
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Metal wireways and auxiliary gutters.
  - 3. Boxes, enclosures, and cabinets.
- B. Related Requirements:
  - 1. Section 078400 "Firestopping" for firestopping at conduit and box entrances.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements

D. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

#### A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AFC Cable Systems, Inc.
  - b. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - c. Anamet Electrical, Inc.
  - d. Calconduit
  - e. Electri-Flex Company.
  - f. FSR Inc.
  - g. Gibson Stainless
  - h. Korkap
  - i. Opti-Com Manufacturing Network, Inc.
  - j. O-Z/Gedney; a brand of EGS Electrical Group.
  - k. Perma-Cote
  - l. Picoma Industries, Inc.
  - m. Plasti-Bond
  - n. Republic Conduit.
  - o. Robroy Industries.
  - p. Southwire Company.
  - q. Thomas & Betts Corporation.
  - r. Western Tube and Conduit Corporation.
  - s. Wheatland Tube Company; a division of John Maneely Company.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated steel.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

#### B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AFC Cable Systems, Inc.
  - b. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - c. Anamet Electrical, Inc.
  - d. Bridgeport Fittings, Inc.
  - e. Calconduit
  - f. Electri-Flex Company.
  - g. FSR Inc.
  - h. Gibson Stainless
  - i. Konkore
  - j. Opti-Com Manufacturing Network, Inc.
  - k. O-Z/Gedney; a brand of EGS Electrical Group.
  - l. Perma-Cote
  - m. Picoma Industries, Inc.

- n. Plasti-Bond
  - o. Republic Conduit.
  - p. Robroy Industries.
  - q. Southwire Company.
  - r. Thomas & Betts Corporation.
  - s. Topaz Electric; a division of Topaz Lighting Corp.
  - t. Western Tube and Conduit Corporation.
  - u. Wheatland Tube Company; a division of John Maneely Company.
- 2. Comply with NEMA FB 1 and UL 514B.
  - 3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 4. Fittings, General: Listed and labeled for type of conduit, location, and use.
  - 5. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Setscrew.
  - 6. EMT Fittings Materials:
    - a. All Steel shall be SAE 1050.
  - 7. EMT Fittings Design:
    - a. Steel parts shall be zinc plated for corrosion protection.
    - b. All Locknuts shall have a dual, precision machined-cut thread, reversible and possess a serrated face on each side.
    - c. All set screw products shall be manufactured with a tri-drive head and staked or modified to prevent disassembly.
    - d. All fitting throat diameters shall be smooth with no sharp edges or slag.
    - e. Rain tight products shall have internal sealing rings to create and maintain a rain tight seal.
    - f. All fittings shall be tested per UL 514B and be listed by Underwriters Laboratories.
  - 8. Transition Fittings:
    - a. All transitions fittings (go-to or from-to fittings) or fittings used to transition from one raceway type to another must be UL listed for that application.
  - 9. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-Line, an Eaton business
  - 2. Hoffman; a Pentair company.
  - 3. Milbank
  - 4. Mono-Systems, Inc.
  - 5. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

### 2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adalet.
  2. Crouse-Hinds, an Eaton business
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. FSR Inc.
  6. Hoffman; a Pentair company.
  7. Hubbell Incorporated; Killark Division.
  8. Kraloy.
  9. Milbank Manufacturing Co.
  10. Mono-Systems, Inc.
  11. O-Z/Gedney; a brand of EGS Electrical Group.
  12. Plasti-Bond
  13. RACO; a Hubbell Company.
  14. Spring City Electrical Manufacturing Company.
  15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
  16. Thomas & Betts Corporation.
  17. Topaz Electric; a division of Topaz Lighting
  18. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Metal Floor Boxes:
1. Material: Sheet metal.
  2. Type: Fully adjustable.
  3. Shape: Rectangular.
  4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are prohibited.
- K. Cabinets:



1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Metal barriers to separate wiring of different systems and voltage.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

- A. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: GRC or IMC.
  6. Boxes and Enclosures: NEMA 250, Type 1.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use setscrew, fittings. Comply with NEMA FB 2.10 and UL514B.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

#### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Do not install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed.
- G. Support within 12 inches of changes in direction.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  - 1. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 2. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
  - 3. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- L. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Raceway Terminations at Locations Subject to Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Conduit extending into pressurized duct and equipment.
  - 2. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  - 3. Where otherwise required by NFPA 70.
- U. EMT, RSC Expansion Joint Fittings:
  - 1. Install in each run of metallic conduit, indoors or outdoors, that is over 100' long in a straight run, or crosses a building (or structure) expansion joint.
  - 2. Weatherproof and approved for use without external bonding jumper.
  - 3. Sizes 1/2" through 4" EMT conduit, 1/2" to 6" RSC/IMC.
  - 4. 4" maximum movement.
  - 5. Electrogalvanized steel body.

- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
  - X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel. Do not install boxes back-to-back.
  - Z. Locate boxes so that cover or plate will not span different building finishes.
  - AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - CC. Set metal floor boxes level and flush with finished floor surface.
  - DD. Install cabinets plumb. Support at each corner.
  - EE. Boxes installed in metal stud and sheetrock walls shall have far-side box support.
  - FF. Boxes shall be secured to metal studs with spring steel clamp which wraps around the entire face of the stud and digs into both sides of the stud. Clamp shall be screwed into the stud.
  - GG. Set outlet boxes for flush mounted devices to within 1/8" of finished wall.
  - HH. Minimum box size to be two gang. For installation of single gang device use properly sized mud ring with thickness to install device within 1/8" of finished wall.
  - II. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- 3.3 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078400 "Firestopping."
- 3.4 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
    - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
    - 2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260544  
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Round sleeves.
  - 2. Grout.
  - 3. Foam sealants.
- B. Related Requirements:
  - 1. Section 078400 "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

- A. Wall Sleeves, Steel:
  - 1. Description: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- B. Sheet Metal Sleeves, Galvanized Steel, Round:
  - 1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch (0.6-mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
  - 1. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.

- B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal space outside of sleeves with grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
    - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
  - 2. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 4. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. All cable bundles shall utilize an enclosed fire rated pathway device whenever said cables penetrate rated walls.

END OF SECTION

SECTION 260548  
SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Restraint channel bracings.
  - 2. Restraint cables.
  - 3. Seismic-restraint accessories.
  - 4. Mechanical anchor bolts.
  - 5. Adhesive anchor bolts.
- B. Related Requirements:
  - 1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The CBC: California Building Code
- B. ICC-ES: ICC-Evaluation Service.
- C. HCAI: California Department of Health Care Access and Information

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Seismic Design Category as Defined in the CBC: D
  - 2. Assigned Risk Category as Defined in the CBC: IV.
    - a. Component Importance Factor: 1.5
    - b. Component Response Modification Factor: Varies
    - c. Component Amplification Factor: Varies.
  - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.498.
- B. It is the responsibility of the delegated design professional to determine which components require special seismic bracing.
- C. Seismic Design Requirements: Design and construct all components, including attachments to structure to withstand seismic design forces in accordance Section 017325 "Seismic Restraint Requirements for Non-Structural Components".
- D. Refer to Section 017325 "Seismic Restraint Requirements for Non-Structural Components" for seismic design criteria and additional seismic restraint requirements

- E. Refer to Section 017325 “Seismic Restraint Requirements for Non-Structural Components” Responsibility Matrix for components identified as “Designated Seismic Systems” and required to meet special seismic certification requirements per ASCE 7, Section 13.2.2

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product:
  - 1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by HCAI.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
  - 1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
    - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
  - 3. Seismic - Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    - d. Preapproval and Evaluation Documentation: By HCAI, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Special Seismic Certification: Provide manufacturer’s pre-approved certification for each Designated Seismic System in accordance with Section 017325 “Seismic Restraint Requirements for Non-Structural Components” and ASCE 7, Section 13.2.2.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints. Electrical components include:
  - 1. Luminaires.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Field quality-control test reports.

## 1.7 QUALITY ASSURANCE

EDIT NOTE:IF AN INDEPENDENT TESTING AGENCY IS REQUIRED, SEE SECTION 014000 "QUALITY REQUIREMENTS" FOR GENERAL TESTING AND INSPECTING AGENCY QUALIFICATION REQUIREMENTS. IF ADDITIONAL CONTROL IS NEEDED, USE FIRST PARAGRAPH BELOW TO SPECIFY 29 CFR 1910.7. 29 CFR 1910.7 DEFINES A NATIONALLY RECOGNIZED TESTING LABORATORY AS IT APPLIES TO TESTING AND INSPECTING FOR SAFETY, AND LISTS, LABELS, OR ACCEPTS EQUIPMENT AND MATERIALS THAT MEET CERTAIN OSHA CRITERIA.

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from HCAi, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- E. CBC 1705a.14.3 for structures assigned to Seismic Design Category D, E or F equipment and components that are subject to the requirements of Section 13.2.2 of ASCE 7 for special seismic certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis or testing as specified therein, Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704A.5.

Active or energized equipment and components shall be certified exclusively on the basis of approved shake table testing in accordance with ICC-ES AC 156 or equivalent shake table testing criteria approved by the building official. Minimum of two equipment/components shall be tested for a product line with similar structural configuration. Where a range of products are testes, the two equipment/components shall be wither the largest and a small unit, or approved alternative representative equipment/components, expect when a single product (and not a product line with more than one product variations) is manufacturing process is ISO 9001 certified, one test shall be permitted for the certification. For multi-component system, where active or energized components are certified by tests, connecting elements, attachments and support can be justified by supporting analysis.

- F. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti Inc.



5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

## 2.2 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
  2. California Dynamics Corporation.
  3. Cooper B-Line, Inc.; a division of Cooper Industries.
  4. Hilti Inc.
  5. Loos & Co.; Seismic Earthquake Division.
  6. Mason Industries.
  7. TOLCO Incorporated; a brand of NIBCO INC.
  8. Unistrut; Tyco International, Ltd.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

## 2.3 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
  2. California Dynamics Corporation.
  3. Cooper B-Line, Inc.; a division of Cooper Industries.
  4. Hilti Inc.
  5. Loos & Co.; Seismic Earthquake Division.
  6. Mason Industries.
  7. TOLCO Incorporated; a brand of NIBCO INC.
  8. Unistrut; Tyco International, Ltd.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

## 2.4 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti Inc.
  - 5. Loos & Co.; Seismic Earthquake Division.
  - 6. Mason Industries.
  - 7. TOLCO Incorporated; a brand of NIBCO INC.
  - 8. Unistrut; Tyco International, Ltd.
  
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.5 ADHESIVE ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti Inc.
  - 5. Loos & Co.; Seismic Earthquake Division.
  - 6. Mason Industries.
  - 7. TOLCO Incorporated; a brand of NIBCO INC.
  - 8. Unistrut; Tyco International, Ltd.
  
- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.6 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
  
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel or powder coat for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
  
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by HCAi.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Equipment and Hanger Restraints:
  - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
  - 2. Install seismic-restraint devices using methods approved by HCAi providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
- C. Seismic controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.6 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 260553  
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Labels.
  - 2. Bands and tubes.
  - 3. Tapes and stencils.
  - 4. Tags.
  - 5. Signs.
  - 6. Cable ties.
  - 7. Miscellaneous identification products.

1.3 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 electrical identification products.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
  2. Legend: Indicate voltage.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  4. Color for Neutral: White.
  5. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- D. Equipment Identification Labels:
1. Black letters on a white field.

## 2.3 LABELS

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers:
    - a. A'n D Cable Products.
    - b. Brady Corporation.
    - c. Brother International Corporation.
    - d. Emedco.
    - e. Grafoplast Wire Markers.
    - f. Ideal Industries, Inc.
    - g. LEM Products, Inc.
    - h. Marking Services, Inc.
    - i. Panduit Corp.
    - j. Seton Identification Products.
  2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  3. Marker for Labels:
    - a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

## 2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
1. Carlton Industries, LP.
  2. Champion America.
  3. Hellermann Tyton.
  4. Ideal Industries, Inc.
  5. Marking Services, Inc.
  6. Panduit Corp.

## 2.5 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
  - 1. Brady Corporation.
  - 2. Carlton Industries, LP.
  - 3. Emedco.
  - 4. Marking Services, Inc.
  - 5. Seton Identification Products.

## 2.6 SIGNS

- A. Laminated Acrylic Plastic Signs:
  - 1. Manufacturers:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Emedco.
    - d. Marking Services, Inc.
  - 2. Engraved legend.
  - 3. Thickness:
    - a. For signs up to 20 sq. inches, minimum 1/16-inch-.
    - b. For signs larger than 20 sq. inches, 1/8 inch thick.
    - c. Engraved legend with white letters on a dark grey background.
    - d. Self-adhesive.
    - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.7 CABLE TIES

- A. Manufacturers:
  - 1. Hellermann Tyton.
  - 2. Ideal Industries, Inc.
  - 3. Marking Services, Inc.
  - 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.

## 2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "POWER."
  - 2. "LIGHTING."
- K. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- L. Self-Adhesive Labels:
  - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
  - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- O. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- P. Metal Tags:



1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Q. Laminated Acrylic Plastic Signs:

1. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

R. Cable Ties: General purpose, for attaching tags.

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "POWER"
  2. "LIGHTING."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in panelboards, pull and junction boxes, use self-adhesive wraparound labels to identify the phase.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Marker tape to conductors and list source.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
1. Apply to exterior of door, cover, or other access.
- J. Equipment Identification Labels:
1. Indoor Equipment: Self-adhesive label.
  2. Equipment to Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic label.
- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Disconnects for any equipment provided by Owner or other trade.
- e. All electrical equipment or devices which are not located within sight of their source of power shall have nameplates listing their source of power (panelboard or switchboard name and number) along with voltage, circuit number, and load served.

END OF SECTION

SECTION 260923  
LIGHTING CONTROL DEVICES

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. Indoor occupancy sensors.
  - 2. Wall dimmer occupancy sensors.
  - 3. Wall-box dimmers.
- B. Related Requirements:
  - 1. Section 262726 "Wiring Devices" for manual light switches and non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Show installation details for the following:
    - a. Occupancy sensors.
  - 2. Interconnection diagrams showing field-installed wiring.
  - 3. Include diagrams for power, signal, and control wiring.
  - 4. Provide coversheet indicating project title, project location, and vendor contact information.
  - 5. Organize submittal into logical sections and provide table of contents.
  - 6. Provide itemized bill of materials indicating model number and quantity for each product.
  - 7. On datasheets with multiple products, indicate which product is provided under this project.
  - 8. Combine electronic submittals into one unified PDF document that is organized per the table of contents. The submittal shall be free of copyrighted files and proprietary file formats. Electronic links may be submitted to supplement product datasheets, but may not be used as a substitute for product datasheets that are required to be included in the unified PDF submittal.
  - 9. Manufacturers' catalog sheets with complete technical data for each item being furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which equipment will be attached.
  - 3. Items penetrating finished ceiling, including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Sprinklers.
    - d. Access panels.
    - e. Control modules.

- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

#### 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
  - 2. Warranty Period: Two year(s) from date of Substantial Completion.

#### 1.7 QUALITY ASSURANCE

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

### PART 2 - PRODUCTS

#### 2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Bryant Electric; a Hubbell company.
  - 2. Cooper Industries, Inc.
  - 3. Hubbell Building Automation, Inc.
  - 4. Intermatic
  - 5. Leviton Mfg. Company, Inc.
  - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 7. Lutron Electronics Co., Inc.
  - 8. NSi Industries LLC; TORK Products.
  - 9. Philips Lighting Controls
  - 10. RAB Lighting.
  - 11. Sensor Switch, Inc.
  - 12. Square D; a brand of Schneider Electric.
  - 13. Watt Stopper.
- B. General Requirements for Sensors:
  - 1. Wall and ceiling-mounted, solid-state indoor occupancy sensors.
  - 2. Passive infrared or dual technology.
  - 3. Integrated power pack for wall-mounted sensors and separate power pack for ceiling-mounted sensors.
  - 4. Hardwired connection to switch.
  - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 6. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Sensor is powered from the power pack.
8. Power: Line voltage.
9. Mounting:
  - a. Sensor: Suitable for mounting in any position on a standard outlet box.
10. Bypass Switch: Override the "on" function in case of sensor failure.
11. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Wall mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
2. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

D. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

## 2.2 WALL DIMMER OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Lutron Maestro 0-10 V Dimmer Sensor Series or comparable product.

B. Description:

1. 0-10V Wall Dimmer Occupancy Sensors:
  - a. Compatible with sourcing electronic 0-10 V drivers, as per IEC 60929 Annex E.2 0-10 V protocol.
  - b. Adjustable sensitivity (high, medium, low, and minimum presets).
  - c. Adjustable high/low end trims.
  - d. Selectable dimming curve (linear or square law).
  - e. Dimmer Features: Locked preset, fade-to-on, fade-to-off.
  - f. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
  - g. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback (Lutron Smart Ambient Light Detection) or as fixed (high, medium, low, and minimum presets).
  - h. Fades lights to off over period of 10 seconds to warn occupant of impending load turn-off.
  - i. Provides visual alert for miswire and incompatible load.

## 2.3 WALL-BOX DIMMERS

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

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.

4. Intermatic, Inc.
  5. Leviton Mfg. Company Inc.
  6. Lithonia Lighting; Acuity Lighting Group, Inc.
  7. Lutron Electronics Co., Inc.
  8. NSi Industries LLC; TORK Products.
  9. Philips Lighting Controls
  10. RAB Lighting.
  11. Sensor Switch, Inc.
  12. Square D; a brand of Schneider Electric.
  13. Watt Stopper.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- C. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- D. Power Failure Recovery: When power is interrupted for periods up to 1 year and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
- E. LED Lamp Dimmer Switches: Modular; compatible with dimming driver;
1. Provide dimmer and driver that are compatible and tested to comply with UL standards.
  2. Continuous Flicker Free dimming range 100% to 10%] measured relative light output.
  3. Meets FCC Part 15 Non-Consumer requirements for EMI/RFI emissions in a typical grounded fixture
  4. Provide dimmers with Pulse Width Modulation for both constant current or constant wattage drivers to maintain LED color when dimming, unless noted otherwise on the Luminaire Schedule.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### 3.3 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Perform the following tests and inspections:
  - 1. Operational Test: After installing sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 262726  
WIRING DEVICES

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. Standard-grade receptacles, 125 V, 20 A.
  - 2. GFCI receptacles, 125 V, 20 A.
  - 3. Hospital-grade receptacles, 125 V, 20 A.
  - 4. Toggle switches, 120/277 V, 20 A.
  - 5. Wall plates.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
  - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
  - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
  - 3. Leviton: Leviton Mfg. Company, Inc.
  - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Provide coversheet indicating project title, project location, and vendor contact information.
  - 2. Organize submittal into logical sections and provide table of contents.
  - 3. Provide itemized bill of materials indicating model number and quantity for each product.
  - 4. On datasheets with multiple products, indicate which product is provided under this project.
  - 5. Combine electronic submittals into one unified PDF document that is organized per the table of contents. The submittal shall be free of copyrighted files and proprietary file formats. Electronic links may be submitted to supplement product datasheets, but may not be used as a substitute for product datasheets that are required to be included in the unified PDF submittal.
  - 6. Manufacturers' catalog sheets with complete technical data for each item being furnished.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Provide separate submittal directly to the Architect for approval of color and finishes of devices and plates. This submittal shall include all samples. Any devices submittal will be reviewed for technical performance only. Color and finishes must be approved by the project Architect.



## 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
  - 1. Model numbers given in Part 2 do not include color designators. Refer to color listed here or as scheduled on drawings.
  - 2. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Eaton. (Arrow Hart is acceptable only where noted.)
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand (Pass & Seymour).

## 2.3 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Convenience Receptacles, 125 V, 20 A
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; 5361 (single), 5362 (duplex). (Arrow Hart AH5362)
    - b. Hubbell; HBL5361 (single), HBL5362 (duplex).
    - c. Leviton; 5361 (single), 5362 (duplex).
    - d. Pass & Seymour; 5361 (single), 5362 (duplex).
  2. Description: Two pole, three wire, and self-grounding.
  3. Configuration: NEMA WD 6, Configuration 5-20R.
  4. Standards: Comply with UL 498 and FS W-C-596.

## 2.4 GFCI RECEPTACLES, 125 V, 20 A

- A. Duplex GFCI Receptacles, 125V, 20A.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton GF20
    - b. Hubbell; GFTT20.
    - c. Leviton 2097
    - d. Pass & Seymour; 2097
  2. 2015 UL 943/CSA C22.2 No 144.1/ANCE NMX-J-250 Compliant.
  3. Self-testing, auto-monitoring with test-fail indication, with disconnection of power in case of test failure.
  4. Straight blade, feed-through type.
  5. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  6. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

## 2.5 HOSPITAL-GRADE RECEPTACLES, 125 V, 20 A

- A. Hospital-Grade, Duplex Receptacles, 125 V, 20 A:
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; 8300S.
    - b. Hubbell; HBL8300.
    - c. Leviton; 8300.
    - d. Pass & Seymour; 8300.
  2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
  3. Configuration: NEMA WD 6, Configuration 5-20R.
  4. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
  5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- B. Hospital-Grade, Duplex GFCI Receptacles, 125 V, 20 A:
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; SGFH20.
    - b. Hubbell; GFRST83.
    - c. Leviton; GFNT2-HG.
    - d. Pass & Seymour; 2097HG.
  2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Single-piece, rivetless, nickel-plated, all-brass grounding system.
  3. Configuration: NEMA WD 6, Configuration 5-20R.
  4. Type: Feed through.
  5. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.

6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- C. Hospital-Grade, MRI Duplex Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; N/A.
    - b. Hubbell; HBL8300\*MRI.
    - c. Leviton; MRI83.
    - d. Pass & Seymour; 8300\*MRI.
  2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
  4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
  5. Features: Made exclusively for MRI room applications – no ferrous materials.
- 2.6 TOGGLE SWITCHES, 120/277 V, 20 A
- A. Single-Pole Switches
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; AH1221.
    - b. Hubbell; HBL1221.
    - c. Leviton; 1221-2.
    - d. Pass & Seymour; PS20AC1.
  2. Standards: Comply with UL 20 and FS W-S-896.
- B. Three-Way Switches, 120/277 V, 20 A
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Eaton; AH1223.
    - b. Hubbell; HBL1223.
    - c. Leviton; 1223-2.
    - d. Pass & Seymour; PS20AC3.
  2. Comply with UL 20 and FS W-S-896.

## 2.7 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch- thick, satin-finished.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
  - 1-2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.
- I. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for rough-in of conduit and equipment, the contractor shall check with other contractors concerned, to determine exact field location of the above items. In addition, he shall check for exact direction of door swings so that local switches are properly located on the strike side.

- J. Where more than one wiring device occurs in any one location, arrange devices in gangs with common cover plate, excluding wall box dimmers. Where ganged switches serving 277V lighting are served by different circuits, so as to result in the voltage between switches exceeding 300V, provide barriers in box per NEC Section 404-8(b).
- K. In locations where several pieces of wall-mounted equipment such as wall switches and thermostats are in the same general area, all shall be installed and grouped in a neat, orderly fashion, all of the same horizontal or vertical center line, whichever the case may be. Variation from this direction shall be approved by the owner or the owner's representative. All receptacles and switches shall be mounted at a height as directed in drawings.
- L. Install devices, accessories, and assemblies level, plumb, square with building lines, and secure.
- M. Install GFCI type receptacles where located in bathrooms or within six feet of a water source.
- N. Devices mounted in boxes which are not flush with the surface of the wall shall be installed so that the mounting yoke or strap of the device is held rigidly at the surface of the wall, but not supported by the wall. Provide washers or spacers to fill in the area between the box and the finished wall line.
- O. Receptacles shall be installed so that the removal of the receptacle does not interrupt the continuity of the circuit.
- P. Receptacles and switches shall have their device screws covered by two wraps of PVC electrical tape. Receptacles with integral hinged plastic covers meet this requirement.
- P.Q. Install Hospital Grade devices in all spaces excluding building support areas.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
- C. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes. Verify fill coloring with Owner, and locations where required. Characters to be 3/16" minimum height.

### 3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Test straight-blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

E.F. Wiring device will be considered defective if it does not pass tests and inspections.

F.G. Prepare test and inspection reports.

END OF SECTION

SECTION 262816  
ENCLOSED CIRCUIT BREAKERS

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. Shunt trip switches.
  - 2. Molded-case circuit breakers (MCCBs).

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.
- B. Shop Drawings: For enclosed circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include wiring diagrams for power, signal, and control wiring.
  - 3. Provide coversheet indicating project title, project location, and vendor contact information.
  - 4. Organize submittal into logical sections and provide table of contents.

5. Provide itemized bill of materials indicating model number and quantity for each product.
6. On datasheets with multiple products, indicate which product is provided under this project.
7. Combine electronic submittals into one unified PDF document that is organized per the table of contents. The submittal shall be free of copyrighted files and proprietary file formats. Electronic links may be submitted to supplement product datasheets, but may not be used as a substitute for product datasheets that are required to be included in the unified PDF submittal.
8. Manufacturers' catalog sheets with complete technical data for each item being furnished.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed circuit breakers, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed circuit breakers to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017800 "Closeout Submittals," include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed circuit breakers.
    - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.

#### 1.8 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.

#### 1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. IBC 1708.5 Electrical equipment. Each manufacturer of designated seismic system components shall test or analyze the component and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by the registered design professional in responsible charge of the design of the designated seismic system and for approval by the building official. The evidence of compliance shall be by actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data (i.e., historical data demonstrating acceptable seismic performance) or by more rigorous analysis providing for equivalent safety. The special inspector shall examine the designated seismic system and determine whether the anchorages and label conform with the evidence of compliance.



## 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

## 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

### 2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

### 2.3 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Bussmann, an Eaton business
  - 2. Littlefuse, Inc.
  - 3. Mersen USA
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- D. Accessories:
  - 1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.

2. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS

- A.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ABB.
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below.
- G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Features and Accessories:
  1. Standard frame sizes, trip ratings, and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

## 2.5 ENCLOSURES

- A. Enclosed Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be:

1. Finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).
- C. Operating Mechanism: The circuit-breaker operating handle shall be:
1. Externally operable with the operating mechanism being an integral part of the box, not the cover(NEMA 250 Type 1).
  2. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

## 2.6 IDENTIFICATION

- A. Controller Nameplates: Metal-backed, butyrate signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Architect no fewer than ten days in advance of proposed interruption of electric service.
  2. Indicate method of providing temporary electric service.
  3. Do not proceed with interruption of electric service without Architect's written permission.
  4. Comply with NFPA 70E.

### 3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

### 3.4 INSTALLATION

- A. Coordinate layout and installation of circuit breakers and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548 "Seismic Controls for Electrical Systems."

- D. Comply with NFPA 70 and NECA 1.

### 3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - (a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - (a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - f. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    - g. Verify correct phase barrier installation.
    - h. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- D. Tests and Inspections for Molded Case Circuit Breakers:
  - 1. Visual and Mechanical Inspection:
    - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and clearances.
    - d. Verify that the unit is clean.
    - e. Operate the circuit breaker to ensure smooth operation.
    - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - (a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - (a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - g. Inspect operating mechanism, contacts, and chutes in unsealed units.

2. Electrical Tests:
    - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
    - e. Determine the following by primary current injection:
      - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
    - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
    - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
    - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
    - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
  3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
1. Test procedures used.
  2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 265119  
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.
- B. Related Requirements:
  - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including occupancy sensors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Provide coversheet indicating project title, project location, and vendor contact information.
  - 2. Organize submittal into logical sections and provide table of contents.
  - 3. Provide itemized bill of materials indicating model number and quantity for each product.
  - 4. On datasheets with multiple products, indicate which product is provided under this project.
  - 5. Combine electronic submittals into one unified PDF document that is organized per the table of contents. The submittal shall be free of copyrighted files and proprietary file formats. Electronic links may be submitted to supplement product datasheets, but may not be used as a substitute for product datasheets that are required to be included in the unified PDF submittal.
  - 6. Manufacturers' catalog sheets with complete technical data for each item being furnished.
  - 7. Arrange in order of luminaire designation.
  - 8. Include data on features, accessories, and finishes.
  - 9. Include physical description and dimensions of luminaires.
  - 10. Include emergency lighting units, including batteries and chargers.

11. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  12. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79 and IES LM-80.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  4. Structural members to which equipment and or luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers
    - d. Sprinklers.
    - e. Access panels.
  7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
- E. Sample warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. LEDs: Provide One for every 5 factory assembled replacement LED package with electrical leads. Furnish at least one of each type. May be unitized with power supply unit/driver.
  2. Power Supply Units/ driver: One for every 5 of each type and rating installed. Furnish at least one of each type. May be unitized with LEDs.



3. Diffusers and Lenses: One for every 5 of each type and rating installed. Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:
  1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
  2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of luminaires in mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
  1. Relative Humidity: Zero to 95 percent.
- B. Altitude: Sea level to 1000 feet (300 m).

## 2.3 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by UL, ETL, CSA, or other qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. CRI as scheduled on drawings. CCT of 3500 K.
- E. Rated lamp life of 50,000 hours.
- F. Lamps dimmable from 100 percent to 10 percent of maximum light output.
- G. Internal driver.
- H. Nominal Operating Voltage: 277 V ac.

## 2.4 LEDS

- A. LED sources must meet the following requirements:
  - 1. Operating temperature rating must be between -40°C and +50°C
  - 2. Correlated Color Temperature (CCT):
    - a. Nominal CCT: 3500 K (3465 ± 245)
    - b. Du'v' tolerance of 0.001 ± 0.006
  - 3. Color Rendering Index (CRI): greater than or equal to 80.
  - 4. Luminaire manufacturer must submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:
    - a. High Temperature Operating Life (HTOL)
    - b. Room Temperature Operating Life (RTOL)
    - c. Low Temperature Operating Life (LTOL)
    - d. Powered Temperature Cycle (PTMCL)
    - e. Non-Operating Thermal Shock (TMSK)
    - f. Mechanical Shock
    - g. Variable Vibration Frequency
    - h. Solder Heat Resistance (SHR)

## 2.5 LED DRIVERS / POWER SUPPLYS

- A. LED drivers must meet the following requirements:
  - 1. Drivers must have a minimum efficiency of 85%.
  - 2. Starting Temperature: -40° C.
  - 3. Electrical Characteristics.
    - a. Volts: 277.
    - b. Phase: Single.
    - c. Hertz: 60.
  - 4. Power supplies can be UL Class I or II output.

5. Drivers must have a Power Factor (PF) of greater than or equal to 0.90.
6. Drivers must have a Total Harmonic Distortion (THD) of less than or equal to 20%.
7. Drivers must comply with FCC 47 CFR Part 15 non-consumer RFI/EMI standards.
8. Inrush current <2A
9. Sound rating: Inaudible in a 24 dB ambient.
10. Class P thermally protected.
11. Drivers with 0-10V dimming capability must be isolated and not allow current to leak between the power source and the 0-10V control circuit.

## 2.6 LED LUMINAIRES

- A. Provide luminaires with integral LED thermal management system (heat sinking).
- B. Luminaires shall be equipped with an LED driver that accepts 120V through 277V, 50hz to 60hz (UNIV). Component-to-component wiring within the luminaire will carry no more than 80% of rated current and be listed by UL for use at 600 VAC at 302°F/150°C or higher. Plug disconnects shall be listed by UL for use at 600 VAC, 15A or higher.
- C. LED modules shall have a minimum L70 service life of 50,000 hours at 25°C ambient temperature and based on IESNA LM-80 methodology.
- D. Provide luminaires with individual LED arrays/ modules and drivers that are accessible and replaceable from exposed side of the luminaire. Luminaires requiring removal or replacement of entire luminaire to access LEDs and drivers will NOT be accepted.
- E. Luminaire efficiency shall be minimum of 70 lumens per watt.
- F. Warranty: 5 year warranty covering the LED arrays, and LED drivers.
- G. Continuous Flicker Free dimming range 100% to 10% measured relative light output.

## 2.7 MATERIALS

- A. Metal Parts:
  1. Free of burrs and sharp corners and edges.
  2. Sheet metal components shall be steel unless otherwise indicated.
  3. Form and support to prevent warping and sagging.
- B. Steel:
  1. ASTM A 36/A 36M for carbon structural steel.
  2. ASTM A 568/A 568M for sheet steel.
- C. Stainless Steel:
  1. 1. Manufacturer's standard grade.
  2. 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

## 2.8 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.9 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## 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.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting not to exceed 2,500 hours of use for LED luminaires. When construction is sufficiently complete, clean luminaires used for temporary lighting.

### 3.3 INSTALLATION

- A. Comply with NECA/IESNA-500, "Recommended Practice for Installing Indoor Commercial Lighting Systems."
- B. Comply with NECA 1.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

F. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - a. If 0-10V dimming does not perform to expectations, the contractor shall provide low pass filters at the 0-10V source to remedy performance issues.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

D. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

E. Advance Notice: Give dates and times for field tests.

- F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
  - 1. Corroded Fixtures: Replace during warranty period.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

### 3.7 INTERIOR LUMINAIRE SCHEDULE

- A. See drawings for Luminaire Schedule.

END OF SECTION

SECTION 265219  
EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Materials.
  - 2. Luminaire support components.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
  - 1. Provide coversheet indicating project title, project location, and vendor contact information.
  - 2. Organize submittal into logical sections and provide table of contents.
  - 3. Provide itemized bill of materials indicating model number and quantity for each product.
  - 4. On datasheets with multiple products, indicate which product is provided under this project.
  - 5. Combine electronic submittals into one unified PDF document that is organized per the table of contents. The submittal shall be free of copyrighted files and proprietary file formats. Electronic links may be submitted to supplement product datasheets, but may not be used as a substitute for product datasheets that are required to be included in the unified PDF submittal.
  - 6. Manufacturers' catalog sheets with complete technical data for each item being furnished.
  - 7. Include data on features, accessories, and finishes.
  - 8. Include physical description of the unit and dimensions.
  - 9. Battery and charger for light units.
  - 10. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
  - 11. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    - a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.

- b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Luminaires.
  - 2. Suspended ceiling components.
  - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  - 4. Structural members to which equipment will be attached.
  - 5. Size and location of initial access modules for acoustical tile.
  - 6. Items penetrating finished ceiling including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
  - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: 1 for every 5 of each type and rating installed. Furnish at least one of each type.
  - 2. Luminaire-mounted, emergency battery pack: One for every 5 emergency lighting units. Furnish at least one of each type.
  - 3. Diffusers and Lenses: 1 for every 5 of each type and rating installed. Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products and complying with applicable IES testing standards.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.



## 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
  - 2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label exit signs and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Internal Type Emergency Power Unit: Self-contained, modular, battery unit, factory mounted within luminaire body.
  - 1. Emergency Connection: Operate luminaire continuously at reduced lumen output upon loss of normal power. Connect unswitched circuit to battery unit and switched circuit to luminaire driver.
  - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    - c. Humidity: More than 95 percent (condensing).
    - d. Altitude: Exceeding 3300 feet.
  - 4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
    - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 5. Battery: Sealed, maintenance-free, nickel-cadmium type.

6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## 2.3 MATERIALS

### A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

### B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

### C. Diffusers:

1. Prismatic acrylic or Clear, UV-stabilized acrylic.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

### D. Housings:

1. Extruded aluminum housing.
2. Clear finish.

### E. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

## 2.4 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA/IESNA-500, "Recommended Practice for Installing Indoor Commercial Lighting Systems."
- B. Comply with NECA 1.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Supports:
  - 1. Sized and rated for luminaire and emergency power unit weight.
  - 2. Able to maintain luminaire position when testing emergency power unit.
  - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- F. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Ceiling Grid Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

- C. Prepare test and inspection reports.
- D. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- E. Advance Notice: Give dates and times for field tests.
- F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- G. Corroded Fixtures: Replace during warranty period.

### 3.5 STARTUP SERVICE

- A. Perform startup service:
  - 1. Charge batteries minimum of one hour and depress switch to conduct short-duration test.
  - 2. Charge batteries minimum of 24 hours and conduct one-hour discharge test.

### 3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
  - 1. Inspect all luminaires. Replace lamps, batteries, signs, or luminaires that are defective.
    - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 2. Conduct short-duration tests on all emergency lighting.

### 3.7 CLEANING

- A. CLEAN LUMINAIRES INTERNALLY AND EXTERNALLY AFTER INSTALLATION. USE METHODS AND MATERIALS RECOMMENDED BY MANUFACTURER.

### 3.8 INTERIOR LUMINAIRE SCHEDULE

- B. SEE DRAWINGS FOR LUMINAIRE SCHEDULE.

END OF SECTION