

Building Department

Final Report - Approved

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<u>General Comments</u>

Markups for this Approved Document or Plan





UCDH PROJECT NUMBER: 9558090 UCDH PROJECT NAME: CANCER CENTER RM 0116C RAD ONC LINAC REPLACEMENT

4501 X STREET, SACRAMENTO, CA 95817

Project Manual 100% Construction Documents

November 07, 2024 (1ST REVIEW RESPONSE)

Boulder Associates Project No. 246664.00





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PROJECT DIRECTORY CCTR RM 0116C RAD ONC LINAC REPLACEMENT Architect's Project No 246664.00

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NOT USED

PROJECT NO. 9558090 CCTR RM 0116C RAD ONC LINAC REPLACEMENT

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NOT USED

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SECTION 01 11 00

SUMMARY OF THE WORK

PARTI- 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
- J. Project Phasing

1.02 DESCRIPTION OF THE WORK

- A. Project is titled: CCTR RM 0116C RAD ONC LINAC REPLACEMENT
- B. University Project No.: 9558090
- C. Project is located at UC Davis Health, Cancer Center, 4501 X Street, Sacramento, California 95817, as shown on the vicinity map.
- D. Project consists of replacement of the existing linear accelerator, fan coil unit and power conditioner with new Accuray Radixact linear accelerator unit. This medical equipment change out will include flooring, ceiling, casework & finishes upgrade. Accessibility upgrades will take place for toilets, dressing rooms and drinking fountain.
- E. A description of areas, types of construction and general nature of the Work are described on drawing G0.01-COVER SHEET.

Phased work for Tomo/Control Rooms, Accessible Toilet Rooms & Accessible Dressing Rooms.

- F. 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 WARRANTS

- 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 (UFCI) PRODUCTS

- 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. Refer to Drawings and Specifications.
- 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. Refer to Drawings and Specifications.
- 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

- 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. HVAC Test and balance work.
 - 2. Commissioning
 - 3. Special Inspections
- 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. Hours of Operation: Construction activities are limited to the hours of 7:00 a.m. to 5:00 p.m., Monday through Friday. Prior University approval is required for Contractor construction work at any other time or day.
- C. 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.
- D. 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

- A. The following portions of the Work are designated for occupancy by University as indicated.
 - 1. Tomo Room 0116C
 - 2. Control Room 0116E
 - 3. Women's Patient Toilet Room 0112A
 - 4. Men's Patient Toilet Room 0114A
 - 5. Women's Public Toilet Room 0103
 - 6. Men's Public Toilet Room 0105

- 7. Women's Dressing Room 0112
- 8. Men's Dressing Room 0114
- 9. Staff Toilet Room 0138
- 10. Staff Toilet Room 0139
- 1.11 PROJECT PHASING
 - A. The WORK OF THIS contract is divided into [3] Phases.
 - The Work of Phase I consists of Tomo/Control Rooms. Phase 2 consists of Accessible Patient Toilet Rooms. Phase 3 consists of Accessible Staff Toilet Rooms, Public Toilet Rooms, and Patient Dressing Rooms. Phasing with Section 013200 – CONTRACT SCHEDULES. Different phases can overlap or be performed concurrently.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not applicable to this Section

END OF SECTION 01 11 00

SECTION 01 14 00

WORK RESTRICTIONS

PARTI - GENERAL

1.01 WORK HOURS

A. 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.

1.02 PROJECT PHASING

a. Refer to Spec Section 01 11 00 Summary of the Work, Paragraph 1.11 Project Phasing.

Note to PM, INSTRUCTIONS for PROJECT PHASING:

PM to edit and identify Phases. The PM shall review the Contract for the Contractor 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 indentified in the Contract.

Delete instructions after editing.

1.03 WORK SEQUENCE and WORK RESTRICTIONS

a. Refer to 1.02 Project Phasing.

1.04 CONTRACTOR'S USE OF PROJECT SITE

- A. Contractor's use of the Project site for the Work and storage is restricted to the areas designated on the Drawings.
- 1.05 UNIVERSITY OCCUPANCY
 - a. Refer to Spec Section 01 11 00 Summary of the Work, Paragraph 1.10 University Beneficial Occupancy.
- 1.06 SUBSTANTIAL COMPLETION
 - A. Substantial Completion shall be applicable to the entire Work.
- 1.07 PROTECTION OF PERSONNEL
 - A. 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.

1.08 WORK SITE DECORUM

- A. 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.
- B. 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.
- C. 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). For more information on the President's Mandate and other related resources, please visit http://uctobaccofree.com/.

D. Alcoholic beverages are prohibited on the University's Project site.

1.09 INTERRUPTION OF BUILDING SERVICES

- A. 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.
- B. 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.
- C. 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.
- D. 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.

1.10 SITE INGRESS AND EGRESS

- A. 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, subcontractors, 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.
- B. Contractor shall take all necessary precaution to ensure the safety of the bicyclists and pedestrians that use the campus roads.

- C. 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.
- D. 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.

1.11 MOTOR VEHICLE AND BICYCLE TRAFFIC CONTROL

- A. 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.
- B. Contractor shall furnish at its 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.
- C. 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.
- D. 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 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.

E. 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.

PART II - PRODUCTS – Not applicable to this Section.

PART III - EXECUTION – Not applicable to this Section.

END OF SECTION 01 14 00

SECTION 01 22 00 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. ALLOWANCE 01 – PROVIDE AN ALLOWANCE TO ADD A MOISTURE CONTROL SYSTEM PER SECTION 090561.13 "MOISTURE VAPOR EMISSION CONTROL", WITH INSTALLATION CONTINGENT UPON MOISTURE TESTING RESULTS PER DIVISION 09 FLOORING SPECIFICATIONS. THE OWNER MAY ELECT TO USE THIS

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ALLOWANCE TO INSTALL A DIFFERENT (LESS EXPENSIVE) SYSTEM DEPENDING ON THE MOISTURE TEST RESULTS.

PART II – PRODUCTS – Not Applicable to this section.

PART III – EXECUTION – Not Applicable to this section.

END OF SECTION 01 22 00

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SECTION 01 25 00

CLARIFICATION/INFORMATION PROCEDURES

PARTI- 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's interpretation, clarification, instruction or decision is subject to removal and replacement at Contractor's 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 01 25 00

REQUEST FOR INFORMATION

RFI #:	Project #:	Proje	ect Title:						
UC Davis Health From: Fr	RFI #:	FI #: Date:			HCAI #:				
Facilities Design & Construction 4800 2** Avenue, Suite 3010, Sacramento, CA 95817 Attn.: Mark Wong P:9167247024 C: 916-494-2318 Email: mdvwong@ucdavis.edu SUBJECT:	UC Davis Health		F	From:					
4800 2 ^{cd} Avenue, Suite 3010, Sacramento, CA 95817 Attn.: Mark Wong P: 916-734-7024 :: 916-434-704 :: 916-434-704 :: 916-434-704 :: 916-434-704 :: 916-704 :: 916-704 :: 916-704 :: 916-704 :: 916-704 :: 916-704 :: 916-705 :: 916-705 :: 916-704 :: 916-704 :: 916-704 :: 916-704 <td: 916-704<="" td=""> <td< td=""><td colspan="3">Facilities Design & Construction</td><td></td><td></td><td></td><td></td><td></td></td<></td:>	Facilities Design & Construction								
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C: 916494-2318 Email: mdvwong@ucdavis.edu SUBJECT:	P: 916-734-7024								
Email: mdwong@ucdavis.edu	C: 916-494-2318								
SUBJECT:	Email: mdvwong@u	cdavis.edu							
SPEC SECTION/DRAWING #: PARA: DETAIL: RM # GRID #	SUBJECT:								
RM # GRID # TRANSMITTAL Requestor to FD&C FD&C to A/E A/E to FD&C Notes Date Submitted Image: State	SPEC SECTION/I	DRAWING #:			PARA:		DETAIL:		
TRANSMITTAL RECORD Requestor to FD&C FD&C to A/E A/E to FD&C FD&C to Requestor Notes Date Submitted					RM #		GRID #		
Date Submitted INFORMATION NEEDED: INFORMATION NEEDED:	TRANSMITTAL RECORD	Requestor to FD&C	FD&C to A/E	A/	E to FD&C	FD&C to Requestor	No	tes	
INFORMATION NEEDED:	Date Submitted								
CONTRACTOR'S PROPOSED RESOLUTION:	INFORMATION N	EEDED:							
REQUESTOR SIGNATURE:	CONTRACTOR'S	PROPOSED RES	OLUTION:						
ATTACHMENTS: REPLY: REPONDER SIGNATURE: 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	REQUESTOR SIG	GNATURE:				REPLY	REQUIRED BY:		
REPLY:		S:							
REPONDER SIGNATURE:	REPLY:								
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.	REPONDER SIGNATURE:				DATE:				
COPIES: University CONSULTANTS C G FILE	UNLESS OTHERWISE IN SUPPLIERS FEEL THAT MANAGER IN ACCORDAI	DICATED ABOVE, THE RE THE REPLY WILL IMPACT NCE WITH THE CONTRACT	PLY TO THIS RFI IS I THE PROJECT COST DOCUMENTS.	NOT INTE OR SCHI	ENDED TO BE A	Change directive. Sh Ld immediately be co	OULD THE CONTRACTOR NVEYED TO THE UNIVER	r, subcontractor, or sity's FD&C Project	
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SECTION 01 25 50

CONTRACT MODIFICATION PROCEDURES

PARTI- 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 2nd 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 01 25 50

SECTION 01 27 00

UNIT PRICES

PARTI- GENERAL

1.01 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.

1.02 SPECIFIED WORK

A. Applicable Sections of the Specifications describe the materials and methods required for the various unit price items of Work.

PART II - PRODUCTS

2.01 UNIT PRICES

- A. List of Unit Price Items exactly as described on Bid Form.
 - 1. UNIT PRICE 01 PROVIDE A UNIT PRICE TO ADD A MOISTURE CONTROL SYSTEM PER SECTION 090561.13 "MOISTURE VAPOR EMISSION CONTROL", IN COST/SQUARE FOOT.

PART III - 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.

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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

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SECTION 01 29 00

MEASUREMENT AND PAYMENT

PARTI- GENERAL

- 1.01 SECTION INCLUDES
 - A. Procedures for preparation and presentation of Application for Payment.
 - B. Procedures for preparation and presentation of Schedule of Values.

1.02 RELATED DOCUMENTS AND SECTIONS

- A. GENERAL CONDITIONS of the Contract: Progress Payments and Final Payment.
- B. Section 013200 CONTRACT SCHEDULES
- C. Section 017700 CLOSEOUT PROCEDURES
- D. Section 017800 CLOSEOUT SUBMITTALS
- 1.03 PAYMENT APPLICATION FORM
 - A. Payment Application Form: Prepare Applications for Payment using Exhibit 4 provided in the Contract.
- 1.04 SCHEDULE OF VALUES
 - A. 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.

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- 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.
- B. 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'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.

1.05 PREPARATION OF APPLICATIONS

- A. 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. Mediadriven forms are acceptable.
 - 2. Execute certification by verified electronic signature of authorized officer of the 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.

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- 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.
- B. Final Payment: Prepare Application for Final Payment as specified in Section 017700 CLOSEOUT PROCEDURES.
- 1.06 SUBMISSION OF APPLICATIONS FOR PAYMENT
 - A. 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 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.
 - 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 shall identify all payment application documents by University's Project Name and University's Project Number.

1.07 SUBSTANTIATING DATA

- A. University's Representative may request substantiating information. Submit data reconciling line-item amounts in question.
- B. 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.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 29 00

SECTION 01 31 00

COORDINATION

PARTI- 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).
- I. 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 preinstallation 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.
 - 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. NA
- 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. 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.
- B. 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.

- C. 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 services will not 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.
- D. 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.
- E. 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.
 - 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.
 - 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.
 - Contractor is advised and shall be prepared, at University written request, to perform certain shutdown and asbestos related work during non-normal time periods.
- F. 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.

- G. 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 ¼" = 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

PROJECT NO. 9558090 CCTR RM 0116C RAD ONC LINAC REPLACEMENT

REQUEST FOR SHUTDOWN (RFS) INFO/IMPACT REPORT

PROJECT NAME: CCTR RM 0116C RAD ONC LINAC REPLACEMENT						
UNIVERSITY RFS#						
PROJECT #: 9558090	HCAI #:	CONTRACTOR RFS #:				
TODAY'S DATE:	SHUTDOWN DATE:	SUSPEND DATE:				
TO: UC DAVIS HEALTH Facilities Design & Construct 4800 2 nd Avenue, Suite 3010 Sacramento, CA 95817 P: 916-734-7024	FROM: ion					
<u>mdvwong@ucdavis.edu</u>						
Request Date:	Shutdown	Target Date:				
Requested By:	Requestor	s Phone #:				
Shutdown Work (Utility Specific):						
Scope (Brief Description of Work):						
Impact (Areas & Users):						
<u> </u>						
Additional Comments:						

DIG NOTIFICATION FORM

PROJECT #: 9558090		HCAI#:			DATE:		
Т	O: UC DAVIS HEALTH Facilities Design & Construction 4800 2 nd Avenue, Suite 3010 Sacramento, CA 95817 P: 916-734-7024		FROM:				
	<u>mdvwong@ucdavis.edu</u>						
1	Has USA been notified?			Ň	/FS	NO	
1.	When?			-		NO	
2.	Are all known utilities marked?			١	/ES	NO	
3.	Location of dig shown on attached si Purpose	ite plan?		١	/ES	NO	
4.	Dates digging will take place Place						

Signed:

UNIVERSITY USE ONLY					
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: S		Signed:			
Corr	ments: (Utilities encountered, disruptions, success	es, weather, etc.)			
Copie	es: University Consultan	ts Fi	le		

SECTION 01 32 00

CONTRACT SCHEDULES

PARTI- 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 01 33 00 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.
 - 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 01 33 00 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. <u>No progress payment</u> 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 *c*alendar 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 01 32 00

SECTION 01 32 20

CONSTRUCTION PROGRESS REPORTING

PARTI- 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** 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** 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 01 32 20

SECTION 01 33 00

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PARTI- 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. 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 resubmittal. 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 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.

1.07 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

PARTI- 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 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

SECTION 01 35 00

SPECIAL PROCEDURES

PARTI- 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 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 development or spread of fire.
- 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.
- E. 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.

- F. 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



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.

· ·	-		1								1				
PROJECT TITLE:	OSHP	D #	A/C#												
ILSM START DATE:	END [DATE:	DATE:												
FIRE LIFE SAFETY DEFICENY(IES):	•														
INTERIM MEASURE(S):															
Unless otherwise noted below, these requirements apply to impairments of a duration extending beyond the current shift (greater than 8 hours)	ILSN	ILSN	ILSN	ILSN	ILSN	ILSN	ILSN	ILSN	ILSN	ILSM	ILSM	ILSM	ILSM	ILSM	ILSM
Check all impairments that apply.		12	13	14	15	16	17	18	61	10	11	12	13	14	15
Construction activity or repair															
Any impairment of a required egress															
Fire detection ALARM system impairment greater than 4 hours ***															
Fire SUPPRESSION system impairment greater than 10 hours															
Fire &/or smoke door hardware impaired															
Fire or smoke barriers with impairment															
Missing or incomplete fire or smoke barriers															
OTHER: See below															
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** 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						
ILSM 1	Life safety deficiencies have been evaluated per UCDH Policy 1635 based upon the submitted ILSM Impact Worksheet						
ILSM 2	Policy for deficiencies is followed for a sprinkler system out of service more than 10 hours in a 24 hour period & fire alarm out of service for more than 4 hours in a 24 hour period.						
ILSM 3	Post signage identifying the location of alternative exits to everyone affected						
ILSM 4	Inspect exits in affected area on a daily basis						
ILSM 5	Provide temporary but equivalent fire alarm & detection system for alarm impa	rment					
ILSM 6	Provide additional fire fighting equipment (i.e. fire extinguishers)						
ILSM 7	7 Temporary construction barrier smoke-tight, will not contribute to the development of fire & of solid construction (see UCDH Policy 1635 & OSHPD 9-3301)						
ILSM 8	8 Increase surveillance of building, special attention to construction area & storage						
ILSM 9	9 Enforce storage, housekeeping & debris removal practices to reduce fire load						
ILSM 10	Provide additional training to those who work in the hospital on the use of fire	ghting equ	ipment				
ILSM 11	Conduct one additional fire drill per shift per quart.						
ILSM 12	Inspect & test temporary systems monthlyDocument testing						
ILSM 13	13 Conduct education to promote awareness of building deficiencies, hazards & temporary measures						
ILSM 14	A 14 Train those who work in the hospital to compensate for impaired structural or compartmental fire safety features						
ILSM 15	ILSM 15 OTHER:						
Respons Date:	Responsible Individual Signature: Date: Date:						



UC Davis Health Fire Marshal's Office 4800 2nd 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	e:		
Date of Pro	ject(s):	Time of Project	ct(s):
A/C#		OSHPD #	
Project Des	scription:		

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



UC Davis Health Fire Marshal's Office 4800 2nd 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

<u>Note*</u> 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:







Interim Life Safety Measures Requirement Verification Card

Contractor	Inspector	Fire Marshal	Comments
Walk each area	Review the progress	Fire Marshal has visited	
indicated by the ILSM	and verify the	the site and reviewed	
and ensure measures	responsible parties	the program with the	
are in place.	adhere to ILSM	responsible parties	
Effective Dates	provisions.		
	Effective Dates		
Daily -Initial and Date	Weekly – Initial and Date	Monthly – Initial and Date	
			-
			-
			1
			4
			-
			-

SECTION 01 39 00

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 DEMOSTRATION 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 UTILITES

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:
 - 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 spells 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 01 39 00

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

PROJECT TITLE: CCTR RM 0116C RAD ONC LINAC REPLACEMENT

COMPANY:

DATE:

		TOTAL AMOUNT GENERATED	AMOUNT RECYCLED	AMOUNT SALVAGED	AMOUNT LANDFILLED
MATERIAL	DESTINATION	TONS	TONS	TONS	TONS
то	TALS				

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

PROJECT TITLE: CCTR RM 0116C RAD ONC LINAC REPLACEMENT

COMPANY:

LOG DATES:

through

		Destination	Tons						
Date	Material		Salvaged	Recycled	Landfilled	Total			
	Totals	-							

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

SECTION 01 41 00

REGULATORY REQUIREMENTS

PARTI- 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 then 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 2022 Edition
 - 1) California Administrative Code, California Code of Regulations Title 24, Part 1
 - California Building Code, California Code of Regulations Title 24, Part 2, Volume 1& 2
 - 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 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 01 42 00

REFERENCES

PARTI- 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
AESA	American Fire Sprinkler Association
	American Galvanizers Association (formerly AHDGA)
	American Garvanizers Association (formerly And OA)
	Associated General Contractors of American
AL	Associated General Contractors of American
	American Institute of Architects
	Acoustical and Insulation Materials Association
	Amorican Institute of Stool Construction
AIGU	American Institute of Steel Constitution
AISI	American fron and Steel Institute
	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
CARO	Council of American Building Officials
CAC	California Administrativa Code (see California Code of Pogulations (CCP)
	State of California Construction Safety Orders
CRE/USHA	California Ruilding Code
	California Dululity Code
CCR	
CEC	
CFC	
CFR	Code of Federal Regulations
CIMA	Construction industry Manufacturers Association
CISPI	Cast Iron Soli 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.

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 Terrazio 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
SEM	State Fire Marshal (California)
SEPE	Society of Fire Protection Engineers
SGCC	Safety Glazing Certification Council
SIGMA	Sealed Insulation Glass Manufacturers Association
SIL	Steel loist 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 <u>Dictionary of Architecture and</u> <u>Construction</u> (Cyril M. Harris, McGraw-Hill Educational; 4th 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

SECTION 01 45 00

QUALITY CONTROL

PARTI- 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:

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

List the applicable services required, for example:

- 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.

- B. University will distribute one (1) PDF electronic copy of the reports to University's Consultants and Contractor.
- 1.12 GEOTECHNICAL ENGINEER
 - 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 01 45 20

SEISMIC CONTROL – NON-HCAI

PARTI- GENERAL

1.01 DESCRIPTION

- A. Provide all required seismic restraints and calculations in order to ensure that the installation is in compliance with all applicable seismic codes, standards, and specific information listed herein.
- 1.02 QUALITY ASSURANCE
 - A. ASTM standards
 - B. 2022 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 drawings and other documentation to comply with the requirements of this Section.

PART II - PRODUCTS

- 2.01 SEISMIC RESTRAINT REQUIREMENTS
 - A. SUMMARY
 - 1. This section covers the seismic restraint requirements for suspended vibration and non-vibration isolated items, systems and/or related suspended equipment.
 - 2. The Design-Builder's, Design Professionals are the designers of record as referenced in this specification shall be the project architect, structural engineer and the appropriate system engineer (e.g., electrical etc.).
 - 3. Department of Health Care Access and Information (HCAI) pre-approved designs may be submitted as an alternate provided they meet or exceed all the requirements contained within these specifications, and provided they meet or exceed all of the HCAI pre-approved service loads, installation applications, engineering services, etc. Furthermore, said other HCAI pre-approved designs must be submitted to the designers of record for review and acceptance, and to the University as a deferred approval prior to installation, with all costs including but not limited to project delay costs, to be borne by the contractor.
 - 4. Channel framing materials, fittings and related accessories shall be as indicated 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.

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 California Building Code (CBC).
 - a. All equipment/components including but not limited to: electrical, mechanical, plumbing, fire sprinklers and architectural.
 - b. Attachment, supports, and seismic restraints that are not shown on the approved construction document 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 designers of record and the University for acceptance prior to installation. Cost to be borne by the contractor.
 - c. Design shall consider seismic relative displacement in accordance with ASCE 7-16 13.3.2.
- 2. Seismic restraint transverse and/or longitudinal spacing shall not exceed CBC requirements and the lesser of the following:
 - a. That which develops seismic design forces equal to or less than the capacity of the building structure.
 - b. That which develops seismic design forces that are equal to or less than the capacity of weakest part, component, anchorage, etc., contained within the seismic brace assembly.
 - c. 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).
 - d. 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).
 - e. 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. Submittals for omission of seismic restraints shall be limited to piping, ducts, and conduits. All submittals for omission of seismic restraints must be signed and sealed by a licensed California Structural Engineer, approved by the University and include the following items:
 - a. Project-specific cover letter clearly indicating that said engineer has (with respect to the attached submittal for omission of seismic restraints) completely review the project documents including these specifications, the items/systems designs individually and in coordination with all other trades, and that all code and/or project specified requirements for omission of restraints have been meet individually and in combination with each other, that (if the attached submittal for omission is approved)
said engineer has been hired/retained by contractor to visit the project site without limit to review and inspect the installation of the items/systems which have been reviewed and approved for installation without seismic restraints.

- b. Engineered details and engineering for all vertical supports and their connections to the building structure to qualify, that top connections cannot develop moments, that lateral motion will not cause loss of item/system support, that lateral motion of the item/system will not cause damaging impact with other items/systems, that lateral motion of the item/system will not directly or indirectly impact any life safety, emergency services and/or hazardous items/systems or their supports.
- 4. Seismic hardware brackets shall provide a (Captive) 360° 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.
- 6. Seismic restraint cables shall be looped through the seismic hardware bracket and turned back onto itself at the point of assembly/connection. Cables shall not be installed or attached to the seismic hardware bracket in a straight through (non-turn back) method of assembly/connection.
- 7. Seismic hardware brackets, connectors and related components shall be constructed entirely of malleable iron or steel. Seismic assemblies shall not include the use of cast components.
- 8. Ceiling and other types of single strand wire shall not be used as a seismic restraint, sway brace and/or safety restraint material.
- 9. The connection to the building structure of non-seismic sway bracing and/or safety restraints shall meet or exceed that required for the attachment of seismic restraints to the building structure.
- Seismic restraints shall be installed to provide a minimum of (2) transverse and (1) longitudinal braces per run. A "run" shall be defined as a length of 5 feet or more.
- 11. The accumulated load of multiple items to any given support (with or without seismic restraints) shall be limited so as not to overload the building structure and the support assembly.
- 12. Trapeze systems installed in a multi-layer configuration shall have seismic restraints designed and installed for each individual trapeze layer.
- 13. Vertical supports shall be designed and installed to account for vertical tension and compression loads including accumulated seismic component increases.
- 14. 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.

- 15. 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 a signed structurally engineered design value based on its installed application and one of the following:
 - a. ICC evaluation report
 - b. HCAI pre-approved
 - 3. Cast-in-place inserts used in concrete or metal decking with concrete fill, shall be constructed entirely of malleable iron or steel.
 - 4. 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.
 - 5. Cast-in-place inserts that allow for horizontal adjustment shall not be allowed unless an engineered solution is provided to assure positive captive positioning and securement of the attachment.
 - 6. 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.
 - 7. 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 of 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 (AHJ) Authority Having Jurisdiction.

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 Title 24.
- C. Lighting fixture supports:
 - 1. Provide independent seismic support system for all lighting fixtures.
- D. Minimum Clearance:
 - 1. Diagonal braces and hanger supports shall maintain 6-inch 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, 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, procedure, and acceptance criteria of post-installed anchors in concrete shall be in accordance with CBC 1901.3.4.

END OF SECTION 01 45 20

SECTION 01 45 50

INSPECTION AND TESTING OF WORK

PARTI- 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

- B. 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.
 - 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. 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)
 - 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 Refer to the following attachment
 - A. Inspection Request
 - B. Non-conforming Work Notice

END OF SECTION 01 45 50

INSPECTION REQUEST

Project #: <u>955</u> Project Name:	58090 HCAI #:	UCDH IR #:	_	Contractor IR #: Spec S	Date: ection (s):
To: UC Dav	is Health	From			
Facilitie	es Design & Construction – In	spection Group			
4800 2 ⁿ	^d Avenue, 2 nd Floor				
Sacram	iento, CA 95817				
Email:	lfuka@ucdavis.edu_& Project	OR	<u>P:</u>		
			E-mail:		
Drawing Re	f.:	Detail:		Shop Drawing:	
Project Sch	edule Activity ID No.:	Date	of Inspection:	Time Requested	l:
Type of Ins Location of etc.):	pection: Inspection (i.e., Floor, Colum	n Line,			
*Re-inspec	tion Requested for Previous I	JCDH IR#:			
All work Re of Inspectio	quested for Inspection has bo on Request.	een reviewed for compliance w	ith the contract documents b	y Contractor's Superintenden	t prior to notification
Signed:			Dat	e:	
Date Receiv	ved:	ONVER		Time of Inspection:	
Date of Insr	pection:	ispector:			Report Attached
Inspector A	rrival Time:	Inspector Departure Ti	me:		
Comments:	·				
	□Approved	□Approved as Noted	□Not Approve	d 🗆 Ca	incelled
	Inspection Request Notes	or Description of Items of Defi	ciency if needed below (Part '	I, Chapter 7, Section 7-145, ite	m 6)
	Project Field Record of C	onstruction Progress Summar	y of Work in Progress (Part 1	Chapter 7, Section 7-145, iter	n 6)
Project Phas	e (Building Foundation, Structu	ral, Wall Framing, Electrical Roug	h-In, Sprinkler Rough-In, etc.)		
Project Pha	se Percentage Complete (% c	f the phase completed):	Overall Pr	oject Percentage Complete:	

NON-CONFORMING WORK NOTICE

PROJECT #: 955	8090	HCAI #:		Notice #:	Date:			
To: [PROJECT MANAGER NAME/EMAIL] [DESIGN PROFESSIONAL NAME/EMAIL] [IF HCAI PROJECT, AREA COMPLIANCE OFFICER/EMAIL]			ER/EMAIL]	From: UC Davis Health IOR Facilities Design & Construction – Inspection Group 4800 2 nd Avenue, 2 nd Floor Sacramento, CA 95817 P: 916-734-5060				
Spec Section Ref.	:		Paragraph:		Drawing Ref.:			
In accordance wit	h Article 12 of	the General Condition	is, the following defecti	ve condition(s)has	/have become apparent:			
Reported by: CORRECTIVE AC NOTICE. COORD NEEDED, ADVICE	TION SHOULD INATE THE VE UNIVERSITY'S	D BE TAKEN AS SOO RIFICATION OF THE S REPRESENTATIVE I	N AS POSSIBLE AND CORRECTIVE ACTIOI N ACCORDANCE WITH	COMMENCE NO L NS WITH THE INS THE GENERAL CO	ATER THAN TEN (10) CALENDAR DAYS AFTE PECTOR OF RECORD. IF FURTHER INFORMAT NDITIONS.			
Description of co	rrective action	taken:						
Accepted by:					Date:			

CC:

SECTION 01 51 00

TEMPORARY UTILITIES

PARTI- 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 its 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:
 - 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. 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.

- 5. 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.
- 6. 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 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 its 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.

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 55 00

VEHICULAR ACCESS AND PARKING

PARTI- 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 (NOT USED)

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

PARTI- 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 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:
 - 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.
 - 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

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

VERIFICATION OF WORK

Type(s) of Inspection Required	Responsible Party			
HEPA Equipment Verification	□ EH&S □ Consultant □ Other:			
Pre-Work Approval Inspection	🗆 EH&S 🗉 Consultant 🗉 Other:			
Daily Onsite Oversight	□ PM □ EH&S □ Consultant □ IOR □ Other:			
Air Sampling Type: Frequency:	□ EH&S □ Consultant □ Other:			
Demolition Inspection	□ PM □ EH&S □ Consultant □ IOR □ Other:			
ICRA Downgrade	□ PM □ EH&S □ Consultant □ IOR □ Other:			
Final Visual Approval Inspection	□ PM □ EH&S □ Consultant □ IOR □ 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 7/4/16 – 0800	B. Clean	-0.025	Y	Y	Y	Y	Y	Y	Ν	closed entry door

ENTRY WARNING SIGN WITH PROJECT MANAGER CONTACT INFORMATION - APPENDIX C

CAUTION 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)

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SECTION 01 56 10

AIRBORNE CONTAMINANTS CONTROL

PARTI- 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 constructionrelated 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.
- 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 <u>daily</u>. 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 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 contruction 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.

6.

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 contractors. 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. ICRAs 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 at the end of 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:
 - A. 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)

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 overs 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
 - 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.

3.05 ADDITIONAL CONTAINMENT CRITERIA

- A. 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 existing 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.
- B. 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.
- C. 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.

3.06 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.

3.07 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 reside 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.

3.08 ENTRY/EGRESS

- A. 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.
- B. 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.
- C. 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 anter room by rolling the disposable coverall inside out and then place it into a garbage container (plastic bag) located inside of the anter room or just inside of the project work area.
- D. 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.

3.09 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.
- 3.10 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.
- E. 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 01 56 10

HEALTH INFECTION CONTROL RISK ASSESSMENT

ICRA Committee approval of an ICRA Permit is required for all Construction Activity

BASIC PROJECT INFORMATION					
Project Name:	Project Number:		Today's Date		
Impacted Department(s):	Building Number an	d Name:	Floor:	Suite/Room:	
Estimated Construction Start Date:		Estimated Completing	on Date:	I	
UCDH Project Manager:	UCDH PM Mobile Pl	l none #:	UCDH PM Email:		
Construction Manager:	CM Mobile Phone:		CM Mobile Email:		
	GENERAL PR	OJECT SCOPE			
	MULTIDISCIP	LINARY TEAM			
Identify the multidisciplinary team inclu	uded in this review and	d agree with the requ	irements identified	within the package.	
Department	N	ame	Er	nail	
UCDH Project Manager					
Fire Marshal's Office					
Infection Prevention					
Environmental Health & Safety					
Contractor Representative					
Other Multidisciplinary Team Members	5				

UCDAVIS

	INFECTION CONTROL RISK ASSESSMENT
Step One: U	sing the table, identify the Construction Project Activity Type (A-E).
Type A	 Inspection and non-invasive activities. Includes but is not limited to: Removal of ceiling tile for visual inspection-limited to 1 tile per 50 square feet with limited exposure time. 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. Clean plumbing activity limited in nature.
Type B	 Small-scale, short duration activities that create minimal dust and debris. Includes but is not limited to: 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). Fan shutdown/startup. Installation of electrical devices or new flooring that produces minimal dust and debris. The removal of drywall where minimal dust and debris is created. Controlled sanding activities (e.g., wet, or dry sanding) that produce minimal dust and debris.
Type C	 Large-scale, longer duration activities that create a moderate amount of dust and debris. Includes but is not limited to: Removal of preexisting floor covering, walls, casework, or other building components. New drywall placement. Renovation work in a single room. Nonexistent cable pathway or invasive electrical work above ceilings. The removal of drywall where a moderate amount of dust and debris is created. Dry sanding where a moderate amount of dust and debris is created. Work creating significant vibration and/or noise. Any activity that cannot be completed in a single work shift.
Type D	 Major demolition and construction activities. Includes but is not limited to: Removal or replacement of building system component(s). Removal/installation of drywall partitions. Invasive large-scale new building construction. Renovation work in two or more rooms.
Type E	 Exterior Construction typical activities. include, but are not limited to: Excavation, Trenching, Grading, Boring, Pile Driving, Demolition Asphalt, Concrete, Stucco, Scaffolding Roofing Window washing, Caulking, Tuckpointing, Cleaning, Painting Landscaping, Planting

Step Two: Using the table below, identify the Patient Risk Group(s) that will be affected. If more than one risk group is involved, select the higher-risk group.				
Low Risk	Medium Risk	High Risk	Highest Risk	
Non-patient care areas	Patient care support	Patient care areas such	Procedural, invasive, sterile	
such as:	areas such as:	as:	support and highly compromised	
			patient care areas such as:	
□Office areas not on	□Waiting / Lobby	□Patient care rooms	□All transplant and intensive care	
clinical units	areas	and areas	units	
□ Breakrooms not on	□Clinical engineering	□All acute care units	□All oncology units and other	
clinical units	□Materials	□Emergency	areas with severely	
□Bathrooms or locker	management	department	immunocompromised patients	
rooms not on clinical	□Sterile processing	□Employee health	□OR theaters and restricted areas	
units	department - dirty side	□Pharmacy: General	□ Procedural suites	
□Mechanical rooms not	□Cafeteria, gift shop,	Work Zone	□Pharmacy compounding	
on clinical units	coffee shop, and food	□ Medication rooms	□Sterile processing department:	
□EVS closets not on	kiosks	and clean utility rooms	clean side	
clinical units	□Public hallways and	□Imaging suites:	□Transfusion services	
□Corridors and	gathering areas near	diagnostic imaging	Dedicated isolation units and	
gathering areas not near	clinical units	□Laboratory	isolation rooms	
clinical units		□Kitchen	□Imaging suites: invasive imaging	
			🗆 Dialysis unit	
Describe key patient risks:				

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.

	Construction Project Activity Type				
Patient Risk Group	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E
LOW Risk					
MEDIUM Risk				IV IV	
HIGH Risk			IV 🗌		
HIGHEST Risk		IV	V	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.

Unit Location:	Below	Above	Lateral	Behind	Front
Unit Name:					
Risk Group:					
Unit Contact:					
Phone:					
Email:					
Additional	🗆 Noise	🗆 Noise	🗆 Noise	🗆 Noise	\Box Noise
Controls:	□ Vibration	Vibration	□ Vibration	Vibration	Vibration
	Dust control	Dust control	Dust control	Dust control	Dust control
	\Box Ventilation	Ventilation	Ventilation	Ventilation	Ventilation
	Pressurization	Pressurization	Pressurization	Pressurization	Pressurization
Impact on other	🗆 Data	🗆 Data	🗆 Data	🗆 Data	🗆 Data
systems, such as:	🗆 Mechanical	🗆 Mechanical	🗆 Mechanical	🗆 Mechanical	🗆 Mechanical
	🗆 Med Gases	🗆 Med Gases	🗆 Med Gases	🗆 Med Gases	🗆 Med Gases
	□ Water Systems	□ Water Systems	□ Water Systems	□ Water Systems	□ Water Systems
Notes:					
Were there discove	eries in surrounding areas	that would serve as a cause	to increase the class of prec	autions and necessitate add	itional controls? If so, ple
summarize.	5				

	NOISE AND VIBRATION ASSESSMENT					
Туре	Suggested Control Measures					
□ Drilling	□ Required for high-impact activities – Notify PO&M, Building Coordinator and EH&S					
🗆 Heavy Equipment	□ Always consider using Engineering solutions before using Personal Protective Equipment.					
□ Motors	□ Coordinate disruption plan with PO&M and other stakeholders as necessary					
Pounding	Deploy noise dampening blankets or other similar equipment					
□ Grinding	\Box Use tools or alternative methods designed to minimize noise and vibrations					
□ Other:	Use diamond drills instead of powder-actuated fasteners					
	\Box Use beam clamps instead of shot					
	Prefab where possible					
	\Box Use tin snips to cut metal studs instead of using a chop saw					
	\Box Install metal decking with vent tabs, then use cellular floor deck hangers					
□ Consider pro-press instead of soldering, brazing, or welding						
Wet core drill instead of dry core or percussion						
	□ Instead of jackhammering concrete, use wet diamond saws					
	Use HEPA vacuums instead of standard wet/dry vacuums					
	\Box Use mechanical joining system sprinkler fittings instead of threaded					
	\Box Where fumes are tolerated, use chemical adhesive remover instead of mechanical					
	To remove flooring, shot blast instead of using a floor scraper					
	□ Use electric sheers instead of reciprocating saw for ductwork cutting.					
	□ Install exterior man/material lifts.					
	□ Provide staff and/or patients with noise-reducing protective equipment (e.g., ear plugs)					
	□ Relocate members/staff to another area of the facility for the duration of the activity					
	□ Notify affected areas before noise or vibration-producing activity					
	□ Schedule activities during hours that minimize patient, visitor, and staff impact.					
	Hours:					
	🗆 Other:					

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

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 N	IATERIALS			
Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)?					
How was this varified?	Hazmat Survey Personal Knowledge				
now was this verifieu?	□ Other:				
Who verified this	Company:				
information?	Person and Department:				
	□ Other:				
Hazardous Materials Present in Project Work Area	Required Con	ntrol Measures			
Hazardous Materials Present in Project Work Area	Follow work practices outlined in the Ger	ntrol Measures	Division 1 De	ocument.	
Hazardous Materials Present in Project Work Area Asbestos Lead	Follow work practices outlined in the Ger	ntrol Measures neral Requirements	Division 1 De	ocument.	
Hazardous Materials Present in Project Work Area Asbestos Lead PCBs	Follow work practices outlined in the Ger	ntrol Measures neral Requirements	Division 1 De	ocument.	
Hazardous Materials Present in Project Work Area Asbestos Lead PCBs Universal Waste	Follow work practices outlined in the Ger	ntrol Measures neral Requirements	Division 1 De	ocument.	

	CON	FAINMENT REQU		NORKSHEET	
	Where construction will	impact fire-rated assembling	es, the contractor	is responsible for construction	ng interim assemblies and Measures may be required
	Full Containment	(poly over all surfaces	within contain	ment)	incasures may be required.
	☐ The ceiling plenum within the work area shall be isolated and sealed by fire-rated six mil. poly				
	☐ Hard Barriers are recommended for work lasting greater than 30 days and in high-traffic areas.				
Containment	□ Fire retardant plastic barriers are recommended for work lasting less than 30 days. Pla				n 30 days. Plastic
Barrier	Barriers cannot	be used where hot wo	ork will be perfo	ormed.	,
24	🗆 Isolated Room – C	Critical Openings Only (seal doors, sup	ply and return registers	s, etc.)
	Prefabricated Cor	ntainment Cube (only la	arge enough fo	or 1-2 people; aka pop-u	p cube or Mini Cube)
	□ Shrouded Tool wit	th HEPA-filtered exhau	ıst		
	🗆 Glove Box Contair	nment with HEPA-filter	edexhaust		
	🗆 Other:				
	The contractor is requi	red to maintain and docu	ument negative a	air pressure. DOP Tested H	IEPA-filtered negative air
	machines (with a minir	num of 99.97% efficienc	y) and a rating of	f 200 to 2000 cubic feet pe	er minute (CFM) is
	\Box -0.020" WC alway	s displayed on a moun	ted digital man	ometer	
Negative	□ -0.020" WC at set	up with negative press	ure throughou	it the project, as display	ed on the manometer
Prossure	□ Visual Verification	of some negative roo	m pressure thr	oughout the project	
Tressure	□ No negative room	pressure is required	•	<u> </u>	
	□ Negative pressure	e in localized HEPA exh	austed work ar	rea (e.g., shrouded tool,	glove box)
	□ Additional Ante room under negative pressure				
	□ Other:				
	\Box Air exhausted directly outside - Avoid exhausting air near air intakes or operable windows doors, and				
	avoid exhausting air near walkways For air exhausted inside, check any of the following conditions that are required: Additional Filtration (ex. Charcoal, Diffuser system)				
Air Exhaust					
	L Exhaust into	Ducts/HVAC system –	Mechanicalen	gineer must confirm tha	it exhausted air will not
		Testing (DOP or partic	e counting) be	em fore containment setur	<u>, </u>
		within last six months	· Fauinment ha	is remained onsite at 110	Н Л
				Brotoctive Clothing	
Additional				FIOLECLIVE CLOTHING	
Containment	U Walk Off Mats	□ Shoe Covers	Collect Sam	nples During Work	🗆 HEPA Vacuum
Requirements	\Box Other:				
	🗆 HEPA Equipment	Verification	🗆 EH&S 🗆 (Consultant 🗌 Other:	
	Pre-Work Approv	alInspection	🗆 PM 🗆 EH	I&S 🗆 Consultant 🗆 IO	R 🗆 Other:
Verification of	🗌 Daily Onsite Over	sight	🗆 PM 🗆 EH	I&S 🗆 Consultant 🗆 IO	R 🗌 Other:
Work	Post Demolition/	Abatement Inspection	🗆 PM 🗆 EH	□ PM □ EH&S □ Consultant □ IOR □ Other:	
	□ ICRA Downgrade			I&S Consultant IO	R 🗌 Other:
	Final Visual Conta	inment Inspection		I&S □ Consultant □ IO	R 🗌 Other:
Air Sompling	Air Sampling			Consultant 🗆 Other:	
Air Sampling	The contractor is response	ible for maintaining air bala	Other:	gh and highest-risk areas per	design/ASHRAE guidelines
Adjacent	Contact PO&M to verify t	he air balance requirement	s of surrounding a	reas.	
Areas:	Adjacent	High/Highest Risk Are	as	Air Balance F	Requirements

ICRA Permit Number

ICRA Class

23-

NP

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 Contracto	r Mobile Email:	
Containment will be set up and maintained by:		Third-Party Containn	nent Consultant:		

ICRA Class:	Choose an Item	Project Start Date	Completion Date
Additional Requirements			
Signatures	Project Manager	General Contractor	Infection Control and Prevention
Downgrade Rec	quest – ICRA Class Choose an item	Project Start Date	Completion Date
Additional Requirements			
Signatures	Project Manager	General Contractor	Infection Control and Prevention
Extension Requ	est – ICRA Class Choose an Item	Project Start Date	Completion Date
Additional Requirements			
Signatures	Project Manager	General Contractor	Infection Control and Prevention

Please include the appropriate Infection Prevention Requirement page(s) for the Class indicated in Step 3 of this package.

	INFECTION PREVENTION REQUIREMENTS - CLASS I
Prior to and During Construction:	 Perform non-invasive work activities not to block or interrupt patient care. Perform non-invasive work activities in areas that are not directly occupied by patients. Perform non-invasive work activity in a manner that does not create dust. Immediately replace any displaced ceiling tile before leaving the area and/or at the end of non-invasive work activity.
Upon Completion of Work:	 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 and air diffuser surfaces. HVAC Systems Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. Verify the HVAC systems meet original airflow and air exchange design specifications.
	Additional Infection Prevention Requirements:

	INFECTION PREVENTION REQUIREMENTS - CLASS II
Prior to and During Construction:	 Perform only limited dust work and/or activities designed for basic facilities and engineering work. Perform limited dust and invasive work following standing precautions procedures approved by the organization. This Class of Precautions must never be used for construction or renovation activities.
Upon Completion of Work:	 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. HVAC Systems: Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. Verify the HVAC systems meet original airflow and air exchange design specifications. Additional Infection Prevention Requirements:

	INFECTION PREVENTION REQUIREMENTS - CLASS III
Prior to and During Construction:	 Provide active means to prevent airborne dust dispersion into the occupied areas. 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. Remove or isolate return air diffusers to avoid dust from entering the HVAC system. Remove or isolate the supply air diffusers to avoid positive pressurization of the space, 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. Seal all doors with tape that will not leave residue 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. 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. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces.
	 Additional requirements for Class III containments that require negative pressure: 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.
Upon Completion of Work:	 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. HVAC Systems: Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. Verify the HVAC systems meet original airflow and air exchange design specifications. Class III 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
	 Work Area Cleaning: Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.

INFECTION PREVENTION REQUIREMENTS - CLASS III

• 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 contaminates 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

- 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 contaminates 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.

INFECTION PREVENTION REQUIREMENTS - CLASS IV

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 contaminates 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

- 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 contaminates 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.

INFECTION PREVENTION REQUIREMENTS - CLASS V

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 contaminates 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:

II	NFECTION PREVENTION REQUIREMENTS – EXTERIOR
Prior to and During Construction:	 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. Contractor must submit an excavation and trenching plan for review and implementation. Install fencing, physical barriers and interior/exterior signage to re-direct pedestrian and vehicular traffic as necessary. If locally required, validate soil survey was performed to identify potential contaminants (e.g., valley fever, radon, legionellosis, etc.). Ensure that fugitive dust control measures are adhered to (e.g., work area is kept wet). Validate those fumes created by equipment and material is controlled. If required, install charcoal filters on air intake to building. Maintain equipment exhaust scrubbers if working near sensitive areas or near air-intake Minimize equipment idling
Upon Completion of Work:	Ensure all control measures are removed at completion of project.
	Additional Infection Prevention Requirements:

UCDAVIS HEALTH

Construction Dust Infection Prevention Best Practice Standard Version 4.0 - January 2023

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PURPOSE

This document represents the minimum best practice standards to prevent the acquisition of nosocomial infection in patients due to exposure to potentially infectious or harmful dust created by construction, renovation, or maintenance activities.

Aspergillus fungal spores carried on dust particles are the most common cause of construction-related infection in healthcare settings. Overall mortality from a healthcare construction and renovation-related fungal infection is 50%. Infection due to construction in healthcare facilities is estimated to cause 5,000 deaths each year in the United States.

The Project Manager, Infection Prevention, and Environmental Health & Safety will audit performance to this standard, as amended by the needs of specific projects. All users of this standard are authorized to contact EH&S directly with questions or for consultation.

SETTING

All work has been evaluated by IP and EH&S and received an Infection Control Risk Assessment (ICRA) permit for construction, remodeling, maintenance, or repair activities at the University of California, Davis Health (UCDH) facilities. This includes external construction and work at leased facilities where owner-provided contractors are used. Work in non-patient care areas such as the School of Medicine and medical research facilities may be excluded.

This standard does not apply to projects contacting hazardous materials, such as asbestos, lead, chemical, or radioactive materials. Projects involving hazardous materials must undergo additional assessment and approval processes. If hazardous materials are discovered during work, immediately contact UCDH Environmental Health & Safety (EH&S) and Infection Prevention (IP) for additional risk assessment.

DEFINITIONS

Anteroom – a small room connected to the entrance of the negative pressure containment, used for donning/doffing protective clothing and adding a layer of insulation between the containment and hospital environment; required on Class IV and V containments.

Containment – a system of barriers and/or negative pressure equipment that isolates the construction zone air space from the adjacent hospital environment.

Critical Barrier – barrier sealed over critical openings into the work area such as HVAC vents, doorways, electrical outlets, gaps in a drop in ceilings, or other openings.

DOP test – filter challenge test; a standard recognized method to test the integrity of a HEPA filter using dispersed oil particulate (DOP) and particle counting techniques which a specialty contractor performs.

HEPA filter – High-Efficiency Particulate Air (HEPA) filter removes 99.97% of particles 0.3 micrometers and is even more efficient for particles of other sizes.

Immunocompromised – having a weakened immune response due to an infection, disease, or immunosuppressive agents such as medication or irradiation.

Infection Control Risk Assessment (ICRA) – process which evaluates patient risk due to construction activities focused on reducing the risk of infection; based on a matrix of the affected patient population and the invasiveness of the work. This assessment generates a permit issued by Infection Prevention requiring compliance with one of five precaution levels (classes). See UCDH Hospital Policy and Procedure 2004.

In writing – written, hard copy, or electronic communications. Electronic communications must be retained in the same manner as hard-copy documents.

Manometer – electronic pressure measuring instrument sensitive to measuring one-thousandth of an inch of water pressure (e.g., -0.024" wp).

Negative pressure – pressure within a system that is less than the environment that surrounds that system; having atmospheric pressure that is less than the ambient atmospheric pressure—examples: vacuum flask (thermos) interstitial space, airborne infectious agent isolation room.

Nonporous – free from minute spaces or holes (pores) where contamination may be trapped; smooth.

Nosocomial Infection – hospital-acquired infection; infection contracted from the environment, staff, or operations of a healthcare facility.

Particle Counting – method of determining ambient particulate concentrations of various sized airborne particles using a laser diode and photodetector; not specific to the nature of the sampled particle.

Poly – polyethylene sheeting; plastic film sheeting used to contain contamination.

Positive pressure – pressure within a system that is greater than the environment that surrounds that system; having atmospheric pressure that is greater than the ambient atmospheric pressure. Example: inside of an inflated balloon or tire.

Patient Care Area – a location where patient care is provided, not limited to direct treatment, and can include waiting rooms, lobbies, food service areas, and other places throughout the facility where patients may be present. Infection risks are elevated in these locations as immunocompromised patients are concentrated.

RESPONSIBILITIES

All parties to this standard must primarily act in the best interests of patients and patient care, regardless of the impact on project timelines or other constraints.

PROJECT MANAGER

The Project Manager (PM) is the Facilities Planning and Development (FP&D) or Plant Operations and Maintenance (PO&M) representative overseeing project execution. The PM oversees the Contractor or inhouse personnel performing the work. A third-party construction manager may supplement the PM's duties, but the UCDH PM retains all responsibility under this best practice standard. The project manager shall ensure the following:

- All work is performed under an approved ICRA
- An Interim Life Safety Measure (ILSM) plan is created, if necessary
- Coordination with work area stakeholders regarding the potential impacts on patient care, including the containment location, project duration, and any changes during construction
- This best practice document is followed throughout the duration of the project
- A qualified consultant is hired for projects (as determined by agreement between FP&D and EH&S) and projects which take place after hours or on weekends
- Plans and specifications (bidding documents) are developed per this best practice standard
- Containment inspectors and consultants perform to this best practice standard
- Contractor expectations are communicated in writing before the start of work
- The Contractor must comply with plan specifications and approved ICRA permit precautions.
- Routine containment inspections are performed and documented by a trained, qualified containment inspector
- Project documentation is maintained
- Containment failures or severe breaches of practice are communicated to EH&S and IP in writing as soon as possible
- Root causes of failures are determined, and corrective action is taken to prevent future episodes
- Work is stopped for excessive noise/vibration, breach of containment, non-compliance with this best practice standard, or other patient care is compromised by the work
- Environmental Services (EVS) is contacted for a terminal clean of the project area after a successful final inspection and containment dismantlement

CONTRACTOR

The Contractor is responsible for complying with all provisions of plans, specifications, and approved ICRA permit precautions to control construction dust at the project site. These provisions include witnessed DOP testing of all HEPA-filtered equipment.

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. The Contractor is required to stop work at times of excessive noise or vibration when containment is breached, when this standard is not being complied with, and when directed by the PM, EH&S, or IP.

CONTAINMENT INSPECTORS

Containment inspectors may perform any of the inspections listed in the "Inspection Criteria" section except for the initial containment inspection (aka "Pre-start"). Containment inspectors must be trained by EH&S (or a qualified consultant) and report to the PM and EH&S.

ENVIRONMENTAL HEALTH AND SAFETY

Environmental Health and Safety (EH&S) is responsible for providing consulting services related to this best practice standard, auditing containment inspector and consultant performance, and updating these best practices document.

EH&S is responsible for ensuring either EH&S or the consultant performs the following:

• Witness DOP testing of HEPA-filtered equipment or perform particle count challenge testing in rare cases

- Complete site inspections according to this best practice standard (must perform the pre-start inspection and approve of the containment design)
- Audits of contractor performance, including particle counting
- Training of containment inspectors
- Environmental sampling, as needed
- Investigation of containment failures
- Stop work for excessive noise/vibration, breach of containment, non-compliance with this best practice standard, or other patient care is compromised
- Along with IP, approve any deviations to this best practice standard

INFECTION PREVENTION

The Department of Hospital Epidemiology and Infection Prevention (IP) is involved in many facets of the control and prevention of nosocomial infections at UC Davis Health System, including infections from construction dust. The IP Department reviews and approves Infection Control Risk Assessments (ICRAs) of construction projects; along with EH&S, approves temporary deviations to this best practice standard to support unique scenarios; and approves this best practice standard document. IP may audit compliance with this Standard and has the authority to stop work for: excessive noise/vibration, breach of containment, non-compliance with this standard, or other project issues compromising patient care.

ENVIRONMENTAL SERVICES

Environmental services (EVS) personnel perform terminal cleaning of project areas once containments have been removed (per UCDH Hospital Policy and Procedure). The PM must provide a 24-hour notification to EVS that terminal cleaning will be needed, in addition to notification when the containment is being removed. Note that containment removal cannot occur until the Contractor has completed a full cleaning of the containment, and the final visual inspection has passed. EVS personnel also occasionally perform final clean inspections for some work.

CONSULTANTS

Consultants retained by FP&D or PO&M provide project scoping, planning, specification, and work plan development, project monitoring for compliance with this standard, and inspection services. EH&S shall approve consultants based on education, training, and experience before beginning billable work. Consultants may only use qualified employees trained and experienced with infection prevention and construction dust control in a hospital setting. Consultants shall be directed by the PM and shall communicate with EH&S and the PM.

POLICY

All work that has received an ICRA Class III*, IV, or V permit must be completed using a negative pressure containment system to separate the construction air space from the hospital environment. This system comprises an enclosed work area and HEPA-equipped filtration units providing negative pressure to the work area. The following policies shall apply to all personnel working with negative pressure containments at UCDH facilities.

TRAINING

All personnel working with negative pressure containments shall be trained and knowledgeable in the following:

- ICRA Permit contents and requirements
- Site-Specific Containment plan
- Provisions of this best practice standard
- Requirements in Section 01561 Airborne Contaminant Control Specifications
- Infection risks associated with construction
- Methods to control the dissemination of dust and fungal spores
- Proper use of protective clothing
- Proper entry and exit procedures
- Manufacturer's requirements, where manufactured containment systems are used (e.g., cubes)
- How to respond to a loss of negative pressure or too much negative pressure
- Breach in Practice response and required notifications
- Contractors shall be additionally trained in the following:
- Proper containment design, construction, and maintenance techniques
- Proper load-out techniques for equipment/wastes
- Containment cleaning regime: daily, final, and terminal cleaning
- Containment Failure Emergencies caused by the Contractor may require retraining at the discretion of the PM, IP, or EH&S. Training is to be provided by EH&S, or an EH&S-approved training provider, such as a consultant.

EXPERIENCE

Contractors, consultants, and containment inspectors shall demonstrate the following experience requirements before performing duties under this standard.

CONTRACTORS

To be considered qualified to work with negative pressure containments, contractors must demonstrate experience by providing either of the following:

- 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.
- Documentation that the contactors' proposed onsite Foreman and onsite Supervisor has successfully obtained one of the following from the American Society for Healthcare Engineering (ASHE):
- Certified Healthcare Constructor (CHC) Certification;
- Health Care Construction (HCC) Certificate; or
- Managing Infection Prevention During the Construction & Operation of Health Care Facilities Course Completion

CONSULTANTS

To be considered qualified to work with negative pressure containments, consultants must demonstrate all the following:

- Hands-on oversight by a Certified Industrial Hygienist (CIH) in good standing with the American Board of Industrial Hygiene (ABIH)
- Field personnel shall be experienced in Healthcare Construction Infection Prevention and shall possess certification in good standing by Cal/OSHA as a California Certified Asbestos Consultant (CAC) or Certified Site Surveillance Technician (CSST)
• Owner references for previously completed, documented negative pressure containment oversight work in healthcare facilities

CONTAINMENT INSPECTORS

Containment inspectors may be trained in-house UCDH personnel or outside, third-party consultants. EH&S shall approve all containment inspectors before commencing inspection tasks. Approval shall include ensuring familiarity with the following:

- The operation, maintenance, and inspection of HEPA-filtered equipment
- Methods to achieve and maintain negative pressure in containments
- Methods to monitor negative pressure
- Inspection elements and documentation requirements

EQUIPMENT

Equipment used for construction containments must arrive free and clean of any debris or significant dust. Equipment that cannot be thoroughly decontaminated must arrive wrapped in 6 mil (0.006 inches) polyethylene sheeting, be used only within negative pressure containment, be wrapped before transport out of the containment, and be transported offsite in a covered cart.

All polyethylene sheeting shall be flame retardant and at least six mils thick. Waste bags shall be six mils thick.

All HEPA-filtered equipment must be tested before being utilized to ensure the integrity of the filter and housing. The equipment will be tested onsite by standard dispersed oil particulate (DOP) challenge testing using a certified independent testing contractor. In rare cases or emergencies, EH&S or an approved consultant may perform onsite particle challenge testing of HEPA-filtered equipment. A legible label indicating the date tested, testing party, and expiration date must be affixed to the equipment for it to be considered compliant with this best practice standard.

Both DOP and particle tests shall be valid for six months from the date of initial testing, provided the Contractor certifies and can verify that the machines have remained at the same building with the same filters in place since initial testing and have not been moved, modified, inverted, or roughly handled in that time. Previously tested equipment removed from the building shall be tested before being reutilized onsite.

PROCEDURE

Best practice procedures must be used wherever possible when working with negative pressure containment systems.

WORK PRACTICES

To minimize the creation of airborne dust, capture and control dust as close to the source of generation as possible. Use water mist, HEPA vacuums, vacuum tool attachments, and/or other methods to prevent the spread of dust within the containment.

Clean as you go and clean up promptly. Vacuum up dust as it is generated. Vacuum out exposed cavities as soon as they are made accessible. The Contractor shall perform daily cleaning of the containment interior by HEPA, vacuuming any noticeable dust, and bagging up debris. Do not leave debris in an unoccupied containment.

The Contractor shall inspect the containment before starting work and immediately repair any breaches, holes, or other issues.

Stop work and notify the PM immediately if unforeseen hazardous materials (including mold) are discovered during construction. This condition will warrant a reassessment of the project by IP and EH&S.

Use only tested, HEPA filter-equipped vacuums. Do not use standard shop vacuums; all vacuums without HEPA filters are dust distributors.

Avoid dry sweeping, dry shoveling, or other dry debris cleanups. Use a water mist or sweeping compound before sweeping or shoveling debris. Do not use compressed air on dust or debris. In occupied areas, provide an effective means of diffusing the air exhausted from HEPA-filtered negative air machines.

PROTECTIVE CLOTHING

Class IV and V containments require protective clothing, including shoe covers. The purpose of this clothing is to protect street clothing from becoming contaminated during work and prevent the track out of dust. Shoe covers may be attached to protective suits or may be worn separately. Head coverings are not required unless dust creation is expected to be extensive, as in the case of abrasive blasting or concrete coring, or head exposure is likely, as in the case of attic crawling. Protective clothing may be disposable (e.g., Tyvek suits) or reusable and regularly laundered.

Note that disposable suits are not typically fire-resistant and, therefore, not intended for hot work environments. If fire-resistive clothing is necessary, it must be brought onsite in a sealed bag, used only within containment, and re-bagged and sealed before offsite transport.

DECONTAMINATION

To avoid tracking construction dust in the hospital environment, workers and equipment must be carefully decontaminated before exiting the containment.

PERSONNEL

For exceptionally dusty work, before removing protective clothing, clean the outside surface using a HEPA equipped vacuum or damp towel/sponge frequently rinsed in clean water. Do not use disinfectants to wipe skin or protective clothing to avoid chemical hazards.

If respiratory protection is used, remove protective clothing before removing the respirator. When removing protective clothing, roll the suit outwards and down the body such that the exterior side is rolled into itself and only the clean side of the suit is exposed. Only touch the inside (clean side) of the suit. Step out of the suit and discard it into a waste bag for disposal or a plastic bag for laundering. If shoe covers are not attached to the suit, remove them by rolling the dirty side onto itself.

Step onto the tack mat several times to remove fugitive dust before stepping onto the flooring outside the work area. Note: The sticky mat is not intended to clean the bottom of the booties. They are designed to clean the bottom of the work boots/shoes after removing booties or full-body coveralls.

When working in semi-restricted or restricted areas, put on clean protective clothing before entering the semi-restricted or restricted area located outside the negative pressure containment.

Wash face, hands, and any exposed skin surfaces as soon as possible upon exiting containment. A wash station near the work area may be required for dusty work.

EQUIPMENT & WASTES

Decontaminate the exterior surface of all bagged waste, tools, or construction materials before the exit of the containment by wet wiping. Tools or materials that cannot be exposed to water may be thoroughly HEPA vacuumed before removal.

Contaminated construction materials, tools, or other reusable items contaminated with dirt or debris must be wrapped in 6 mil plastic sheeting or bags any time they are outside the containment and before covered cart transport. Insides of transport carts shall be maintained free and clean of dust and debris. Nonporous/smooth and cleanable containers with a hard lids must be used to transport trash and debris from the construction areas. Before leaving the contained work area, these containers must be damp-wiped, cleaned, and free of visible dust/debris. Open carts or plastic-covered carts are unacceptable.

CONTAINMENT DESIGN & CONSTRUCTION

Containment is the primary engineering control to prevent patient exposure to contamination. Proper containment design and construction are necessary for proper function. The following sections are related to whole, negative pressure containments; alternative containment strategies are presented in the next section.

LOCATION

Nurse management must approve the containment location and configuration in patient care areas. Containment location concerning emergency egress must be reported to UCDH Fire Marshal's Office. An Interim Life Safety Measure (ILSM) plan may be required.

MATERIALS

Temporary containments in non-fire-rated locations lasting less than 30 days may be constructed of fire-rated polyethylene sheeting (at least six mil in thickness) that meets the standards specified by the UCDH Fire Marshal's Office. The polyethylene used for critical barriers and 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, (no known equal).

Only approved one-hour fire-rated temporary containment systems that meet ASTM E84, Class A requirements for smoke and fire for fire-rated assemblies/enclosures shall be used. Only approved fire damper systems used to control smoke/fire in a fire-rated containment assembly shall be used.

Containments to remain in place for more than 30 days, those requiring additional security or those designed to control highly dusty environments, as in the case of abrasive blasting or concrete coring, shall be constructed of rigid, airtight materials, such as drywall and metal wall framing. A hard-sided containment with a lockable door shall be used when there are concerns about security or safety from unauthorized entry, especially if the containment will be left unattended for extended amounts of time. Avoid creating tape damage on existing finish materials.

CONSTRUCTION

Locate the HEPA-filtered negative pressure unit as far away from the containment entrance (or other location of makeup air) as possible and duct the exhaust outdoors whenever feasible. Distancing the negative pressure unit from the source of makeup air helps to ensure complete and effective scrubbing of the contained airspace. Locating the unit too near the entrance can allow pockets of contamination to exist within the contained zone. At least four air changes per hour must be provided within the negative pressure containment at all times, which can be determined by the number of HEPA-filtered negative air unit scrubbers operating cubic feet per minute and the volume of the containment. All sources of air infiltration into the work zone must be sealed off before erecting containment barriers. These critical barriers include those over HVAC supply and return registers, electrical outlets, gaps in the drop-in ceilings, doorways not being used, etc.

All existing surfaces within the containment which are not to be disturbed during construction must be covered with polyethylene sheeting unless they are nonporous, smooth, and accessible for cleaning. Where floors are likely to be damaged by the construction activities, durable flooring (e.g., plywood, Masonite) shall be installed over two layers of plastic sheeting.

Locate tack mats outside of the containment exit when possible. Otherwise, locate tack mats on the floor, just inside the containment exit. An additional tack mat may be useful for incredibly dusty projects. Expose a new tack sheet when tack mats are no longer sticky and again at the end of each shift. The use of wetted carpet mats is not acceptable.

When required, a manometer displaying the current containment pressure must be installed in an accessible location near the containment entrance.

NEGATIVE PRESSURE REQUIREMENTS

Negative pressure containments shall be a minimum of -0.020 inches of water column or less (-0.021, -0.022, -0.023....) relative to the adjacent, uncontained space. Exceptions to this requirement may be allowed by IP and will be listed on the ICRA permit. Demonstrate negative pressure is achieved continuously (24/7) through 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. Inclined manometers using a liquid water solution and non-digital air pressure gauges are unacceptable since they do not meet the sensitivity of measuring -0.001" WC.

Zero pressure or positive pressure is unacceptable and must be responded to immediately. Locate and repair holes or breaches in the exterior containment system with tape. Secure zip poles if they have fallen. Close the entry door by zipping lower or closing the flaps and securing it. A pressure too negative (-0.060 inches of water column or less) can cause the containment to collapse inwards. To relieve too negative pressure, turn down the negative air machines, if possible, and increase the size of the containment door openings.

Manometer Reading	Why it's a problem	Response Options
Positive Pressure	Active contaminant	This is an emergency. Call Project Manager ASAP!
(+0.001 and greater)	ejection	
No pressure	Possible	Close zipper doors, Check and repair breaches, Ensure
(0.000)	contaminant	correct operation of negative air machines, and Call
	migration	Project Manager.
Too Negative	Could collapse	Lift the zipper on the containment and anteroom door
(-0. 060 and less)	containment	

ALTERNATIVE CONTAINMENT STRATEGIES

A full negative pressure enclosure is not always possible or warranted. Work may be completed using alternative containment strategies such as those listed below. IP may approve other alternative containment strategies on a case-by-case basis.

MOBILE CONTAINMENTS, AKA "CUBES"

Cubes are manufactured containment systems that are erected on a mobile platform. Examples are pictured on the following page. They are most often used for Class III or IV work and must conform to all Class III or IV ICRA permit requirements, including negative pressure, cleaning, inspection, required postings, etc.

Cubes are not typically inspected at the same frequency as fixed containments as the work is often of short duration and may occur in several locations throughout a single day.

The containment inspector shall conduct periodic, unannounced audits of cube work to ensure compliance with the ICRA and this best practice standard. Inspect cube operations two times or more for each ICRA permit issued. Projects longer than two weeks shall be audited at least twice per month. Where failures are located, corrective action must be taken immediately.



"GLOVE" BAGS OR BOXES & HEPA SHROUDS

Small projects may be accomplished by containing the work only - and not the workers. Glove bags, boxes, and HEPA shrouds can be used to complete work that disturbs small areas. Some examples of these systems are pictured on the following page.



EXAMPLES HEPA SHROUDED SYSTEMS



Projects commonly completed using these systems include drilling small penetrations, cutting in for wire receptacles, and placing backing plates for hanging objects from the wall. Because the containment cannot be posted, display the required postings (including the ICRA permit) in the work area. Before first use, the design and construction of these types of containments shall be approved by IP and EH&S.

The glove bag or box should be composed of a sturdy frame enclosed in polyethylene or a transparent, sturdy material (e.g., plastic panel). Do not use corrugated materials, as they tend to collect and retain dust. A tested HEPA vacuum is used to maintain negative pressure within the glove bag/box. The bag/box must be cleaned before detachment. The negative pressure may be verified by observing the bowing of the bag/box sides, using visible smoke, tissue paper, or other means approved by EH&S.

Work utilizing these types of containments is typically very short in duration; therefore, inspections differ from those performed in fixed containments. Further, because these types of systems heavily rely on the work practices used, contractors must be strictly monitored, especially at the beginning of a project.

The containment inspector shall conduct periodic, unannounced audits of the work to ensure compliance with the ICRA permit and this best practice standard. Where failures are located, corrective action must be taken immediately, and EH&S must be notified immediately.

DEHUMIDIFICATION

Dry-out efforts using dehumidifiers are allowed if completed within 72 hours of initial wetting and are approved by EH&S and/or IP. If the duration of the wetting is unknown, additional measures must be performed to ensure no mold growth has occurred – consult with EH&S.

Dehumidification may only be used in clean water or steam condensate intrusion cases. Materials wetted by contaminated, black, or grey water require measures beyond dehumidification, ideally removal and replacement.

Dehumidification of voids such as wall or ceiling cavities must be done as a closed loop such that the space does not become positively pressured relative to patient care areas.

POSTINGS

All the following postings must be maintained in the work area at all times a Class I-V permitted project is in progress:

- Copy of ICRA Permit
- Copy of Interim Life Safety Measure (ILSM) Permit
- Conatinment Inspection Log (See Appendix A)
- Entry Warning Sign with Project Manager Contact (See Appendix B)

CLEANING PROCEDURES

Once all work has been completed within containment, use the following procedures to perform a final cleaning. Final cleaning must be verified and signed off by the containment inspector before removing the containment.

- Change into a clean disposable suit or clean clothing.
- Carefully HEPA Vacuum all surfaces. 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.
- Prepare a measured solution of a UCDH-approved EPA-listed disinfectant (see UCDH Hospital Policy and Procedure 2111) and use it according to the instructions on the label.
- Using clean towels or sponges, wipe all surfaces with 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 it to air dry. Do not wipe dry.
- Remove the top floor layer, if present, and HEPA vacuum and wipe down the bottom floor layer.
- Call for a final visual inspection. The inspection will not be performed until the containment is dry.
- If the containment does not pass inspection, the entire containment must be re-cleaned using the steps outlined above before re-inspection.
- When containment passes inspection, remove the components, retain the documents for the project manager, and contact EVS for terminal cleaning of the project area.

DOCUMENTATION

The project manager shall retain all the following documents related to the containment:

- Copy of ICRA permit
- Containment Inspection Log (see Appendix A) and any Manometer Logs
- Copies of HEPA equipment certification
- Records of sampling conducted, if any
- Findings from project audits
- Documents should be retained until the project is completed and occupancy has been granted.

CONTAINMENT VERIFICATION

Periodic particle counting is recommended and may be required to ensure exhausted air meets the HEPA rating and ambient air near the project is not excessively loaded with particles, compared to baseline measurements collected before construction or measurements collected in areas deemed currently acceptable. Particle counters should be set to log the collected data, and all sampling records must be provided to the project manager and EH&S.

INSPECTION CRITERIA

Inspections are required: at the initial containment setup to verify proper construction each day to ensure a proper operation once all demolition has been completed, whenever an ICRA reclassification is requested, and when all work has been completed, and the containment has been cleaned. The requirements of each of these types of inspections follow.

INITIAL CONTAINMENT INSPECTION (AKA "PRE-START") - EH&S OR CONSULTANT ONLY

To ensure the containment is sufficient before the start of work, EH&S or the consultant shall check for the following and sign off on the posted "inspection documentation form" with their name and the date and time the pre-start inspection passed.

[]ILSM permit conditions are met (if applicable) All equipment is free and clear of dust/debris or arrives wrapped in poly A hard lid-covered cart is available for waste transport HEPA-filtered equipment has passed inspection and is not expired Protective clothing is available HVAC is sealed off in the work area, and other critical barriers are in place Containment is complete (no holes/gaps) and structurally sound Negative pressure exhaust is located as far from containment entry as possible Nonporous, non-cleanable surfaces not in the scope are covered in poly Fixtures outside of the scope of work are covered or removed Where floor damage may occur, durable floor protection is in place Installed manometer displays sufficient negative pressure Negative pressure exhaust is diffused/not directing high-velocity air onto occupants All required postings are in place

INSPECTIONS WHILE WORKING

Containment inspections shall be performed at least once per workday. For projects of extended length when work activity is not being performed, including on weekends or holidays, and if the work area had a comprehensive 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. Containment checks shall include the following. The containment inspector shall note observations on the "Containment Inspection Form" (see Appendix A) attached to the containment.

- ILSM permit conditions are met (if applicable)
- Containment remains complete (no holes/gaps/tears) and structurally sound
- No unauthorized personnel are inside
- All required postings are in place
- No changes to the location of the HEPA exhaust
- The Tack mat is present and usable
- No signs of track out are observed
- Installed manometer displays sufficient negative pressure
- Containment is generally clean
 - Covered carts with hard lids are being used to transport equipment and wastes
 - All ICRA permit conditions are met

IN-PROGRESS INSPECTIONS (AKA "POST-DEMO")

To ensure completion of the demolition phase of projects, the containment inspector shall verify the following conditions and sign off on the containment documentation form with their name and the date and time the inspection was completed.

- All wetted or hazardous materials have been removed entirely (May require using infrared cameras and/or moisture meters to verify remaining materials are dry).
- The demolition scope is complete

Π

- No hazardous materials have been discovered
- Containment is clean, and waste has been removed

ICRA CLASS CHANGE (AKA "ICRA DOWNGRADE")

At times, with the approval of IP, construction work may begin under ICRA Permit Class III, IV, or V and become reclassified to a lower ICRA Class once significant dust-producing activities have ceased. An inspection must take place before the downgrade to ensure that the dust-producing work is complete, the Class III or IV containment is clean, and the IP requirements of the ICRA permit downgrade are met. The containment must meet the criteria for a "final visual inspection" (see next section), except for all construction efforts being complete.

FINAL INSPECTION BEFORE DISMANTLEMENT (AKA "FINAL VISUAL")

Once the construction is complete, a containment inspector shall verify the following and document a passing final inspection by signing the inspection log form attached to the containment, including the date and time the inspection passed. Before dismantling the containment, the Contractor shall collect all posted paperwork, including any manometer tapes, and deliver it to the Project Manager, who is responsible for contacting EVS for the terminal cleaning.

- All construction efforts are completed
 - No tools, equipment, or personal belongings are present (clean ladder excepted)
- No debris or wastes are present
 - The Tack mat is clean
 - Containment is "white glove" clean no visible dust can be wiped from any surface

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Project Manager Phone Number:	ate Contact:
ICDH Project Manager: UCDH	roject Name: Altern
Permit Number:	Project Number:

Corrective Actions		Containment Breach; Patched										
Other Issues? (Explain)		No										
All ICRA permit conditions	met? (Yes/No)	Yes										
Containment Integrity Intact?	(Yes/No)	No										
LIIUN L Interior free of dust and	debris? (Yes/No)	Yes										
Tack Mat useable?	(Yes/No)	Yes										
AIIVIEN I ILSM conditions still met?	(Yes/No or N/A)	N/A										
Acceptable Negative Pressure?	(Yes/No)	Yes										
Pressure Reading (+/-)		-0.025										
Performed by (Name & Company)		B. Clean ACME Construction										
Date & Time		01/13/23 0800										
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Caution

Construction Dust Precautions In Use Do Not Enter

For More Information Contact the UCDH Project

Manager

(Name)

This sign must be posted in color

Phone Number

SECTION 01 61 00

PRODUCT REQUIREMENTS

PARTI- 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 for **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.
 - 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 Deign 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 welldrained 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 01 61 00

PROJECT NO. 9558090 CCTR RM 0116C RAD ONC LINAC REPLACEMENT

REQUEST FOR SUBSTITUTION

Substitution #:	Submittal #:		Date:				
Project#: 9558090		HCAI#:					
PROJECT NAME:	CCTR RM 0116C RAD ONC LIN	AC REPLACEMENT					
TO: UC DAVIS HE Facilities Des 4800 2 ND Aver Sacramento, P: 916-734-70	ALTH ign & Construction nue, Suite 3010 CA95817 24	FROM:					
Attn.: mdvwong@ucdavis.edu Name of Party Submitting Request for Substitution:							
Reason for Submitti	ng Request for Submission:						
Specification Sectio	n and Paragraph #:						
Substitution Manufa	cturer name and address:						
Proposed substitution (trade name of product, model or catalog #):							
Fabricators and Sup	opliers (as appropriate):						

PRODUCT DATA:

ATTACH PRODUCT DATA AS SPECIFIED IN SPECIFICATION SECTION 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Similar projects using product (list dates of installation and names/phone numbers of Owners):

Similar comparison of proposed substitution with specified product (indicate variation(s), and reference each variation to appropriate Specification Section paragraphs):

-ATTACH COMPARISON SUMMARY-

(SUBSTITUTION REQUEST CONTINUES)

Quality and performance comparison between proposed substitution and specified product:

Availability of maintenance services and replacement materials:

Effect of proposed substitution on Construction Schedule:

Effect of proposed substitution on other work or products:

SECTION 01 73 00

CUTTING AND PATCHING

PARTI- 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

- Α. 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 the online Hazardous Conditions shall complete 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 form 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

	PROJECT#			± 9558090		
LOCATION:			E:	CCTR RM 0116C RAD ONC LINAC REPLACEMENT		
TRACKING NUMBER: (Provided by PO&M)						
HCAI #:		DATE:				
TO: Facilities Design & Constructi UC Davis Health 4800 2 nd Avenue, Suite 3010 Sacramento, CA 95817 P: 916-734-7024 <u>mdvwong@ucdavis.edu</u>	on	FROM:				
SCOPE:						
HAS USA BEEN NOTIFIED?	□ YES		Whe	nen?		
ARE ALL KNOWN UTILITIES MARKED?	□ YES		By V	Whom?		
LOCATION OF WORK SHOWN ON ATTACHED SITE PLANS? DATE(S) CORING OR SAWCUTTING	U YES	D NO PLACE:	Purp	rpose: Signed:		
	UC DAV	IS HEALT	HUSE	ONLY		
DATE RECEIVED:						
WHO FROM UNIVERSITY WILL AUT PHONE:	HORIZE, SU	PERVISE	and ve	/ERIFY?		
Utilities Verified by IOR?	□ YES	🗆 NO				
Activities coordinated with:	☐ PO&M ☐ Other (It	Fire Eire	🗌 Tele	lecom 🔲 Occ. Safety		
COMMENTS:						
DATE AUTHORIZED:	Signed: PO&M:	University	/ Repres	esentative		
COMPLETION DATE:						
COMMENTS: (Unknown Utilities Encountered, Disruptions, Successes, Weather, etc.)						
SIGNED:						
Copies to: University Consultants, PO&M.	Fire, Telecom.	File, Others	s:			

SECTION 01 74 00

CLEANING

PARTI- 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 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 antipollution 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

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction or designated spoil area on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvaged Materials: Materials recovered for subsequent sale or reuse.
- F. Universal Waste: Common hazardous waste materials as defined by 40 CFR 273, and as further defined by the State having jurisdiction.

1.3 MATERIALS OWNERSHIP

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

1.4 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. Develop waste management plan that results in 65% for salvage/recycling of total non-hazardous solid waste generated by the Work, calculated as a percent by weight or volume of total waste generated by the Work. Use one unit of measurement consistently. Excavated soil and land-clearing debris shall be repurposed and calculated separately.
 - 2. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert demolition and construction waste from landfills and incinerators. Facilitate recycling and salvage of materials.
- B. Regulatory:
 - 1. Meet all requirements of the local jurisdiction.
 - 2. Manage and dispose of universal waste per the requirements of the authorities having jurisdiction. Provide verification documentation when requested.

1.5 SUBMITTALS

- A. Waste Management Plan: Submit plan within 14 days of date established for commencement of the Work.
- B. Final Waste Reduction Report: After waste containers are removed from the Project site, and before Application for Final Payment, submit final report indicating calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Refrigerant Recovery: Comply with requirements in [ection 024119 "Selective Demolition" for refrigerant recovery submittals.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- C. Waste Management Coordinator: Identify a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- D. Record Keeping: Contractor shall maintain records of the disposition of all waste.
 - 1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
 - 2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
 - Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 - 4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

- A. General: Develop a Construction And Demolition Waste Management Plan according to requirements in this Section. Plan shall consist of waste identification and waste reduction work plan. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan:
 - 1. Plan must comply with the requirements outlined in Section 5.408.1 of the 2022 California Green Building Standards Code.
 - 2. Plan may include on-site sorting, off-site sorting, or a mixture of the two.
 - a. Off-site sorting must adhere to one of the following requirements:
 - 1) Off-site sorting facility must provide project-specific diversion rates of comingled debris, or
 - 2) Off-site sorting facility must be regulated by a local or state government authority regarding the facility's method of recording and calculating the recycling rate.
 - a) If this path is used, the average annual recycling rate for the specific sorting facility is to be used for the calculations.
 - 3. Plan must identify the following:

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- a. Contractor's designated Waste Management Coordinator
 - 1) Include name, address and telephone number.
- b. Hauler(s).
 - 1) Include names, addresses, and telephone numbers.
 - 2) Identify if registered with a state or local government authority.
- c. Construction [demolition and] waste recycling and processing facilities.
 - 1) Include names, addresses, and telephone numbers.
 - 2) Identify if registered with and/or regulated by a state or local government authority.
- d. Diversion goals.
- e. Waste Reduction Work Plan:
 - 1) List each type of waste and whether it will be salvaged, separated on-site, sent to a construction and demolition waste facility to be separated off-site, disposed of in a landfill or incinerator, or requires special handling.
 - a) Salvaged Materials for Reinstallation: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with [Section 013516 "Alteration Project Procedures"] [Section 024116 "Structure Demolition."] [Section 024119 "Selective Demolition."]
 - b) Salvaged Materials for Reuse in Another Facility: For materials that will be salvaged and reused in another facility, identify level of disassembly required, the location to which the materials are to be delivered, and the names, addresses and telephone numbers of the receivers.
 - c) Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers. Identify who is responsible for transportation, addresses where the materials are to be delivered, and any restrictions as to when the subsequent owner can take possession.
 - Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - e) Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - f) Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - g) Food Beverage and Office Waste: For materials brought onto the project site that are not intended for incorporation into the project, describe methods for sorting this material so as not to contaminate construction waste.
 - Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- f. Waste tracking requirements.
 - 1) The amount of construction waste materials diverted shall be calculated by weight or volume, but not both.
- 4. Contractor may use the following estimated material conversation factors:

a.	Cardboard	100 lbs/cy
b.	Gypsum Board	500 lbs/cy
C.	Mixed Waste	350 lbs/cy
d.	Rubble	1,400 lbs/cy
e.	Steel	1,000 lbs/cy

f. Wood 300 lbs/cy

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved Construction And Demolition Waste Management Plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement Waste Management Plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
 - 2. Plan shall be updated as necessary, and shall be accessible during construction for examination by the enforcing agency.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned, and review with each trade as they begin work on the site.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for collection and/or separation of materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reinstallation in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Lighting Fixtures: Separate lamps by type and protect from breakage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
- 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 01 75 00

STARTING AND ADJUSTING SYSTEMS

PARTI- GENERAL

- 1.01 SECTION INCLUDES
 - A. Procedures for Starting Systems
- 1.02 REALATED 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 01 76 00

PROTECTION of EXISTING and INSTALLED CONSTRUCTION

PARTI- 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 01 76 00

SECTION 01 77 00

CLOSEOUT PROCEDURES

PARTI- 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 SUBMITALS (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
 - 4. Changes under unit prices
 - 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 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 01 78 00

CLOSEOUT SUBMITTALS

PARTI- 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][CM/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.
 - 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-Builts". 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:

- 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

- 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

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	
	("Contractor").
(Name of Contractor or Subcontractor)	
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 interests; and has been completed in accordance with Specification SECTION	; free from any liens, claims, and security and the
The undersigned further agrees that, if at any time within months after the date of the guarar University that the aforesaid portion of the Work is unsatisfactory, faulty, deficient, incorrequirements of the Contract, the undersigned will, within 10 days after receipt of such notic of the Work, together with any other parts of the Work and any other property which is defective portion of the Work or the correction, repair, or replacement thereof; and that it should correction, repair, or replacement to completion.	ntee the undersigned receives notice from implete, or not in conformance with the re, correct, repair, or replace such portion amaged or destroyed as a result of such hall diligently and continuously prosecute
In the event the undersigned fails to commence such correction, repair, or replacement within and continuously prosecute the same to completion, the undersigned, collectively and sepa undertake such correction, repair, or replacement at the expense of the undersigned; and Cc upon demand all costs and expenses incurred by University in connection therewith.	n 10 days after such notice, or to diligently arately, do hereby authorize University to ontractor will pay to University promptly
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:	

REPORT OF WORK REQUIRED BY WARRANTY

To:	Mark Wong, University Representative
From:	

On the date noted, the University identified the following work required under warranty:				

Prepared by:			
	(Print Name)	Signature	Date

Prompt notification to be provided by the University Representative to the appropriate **Contractor**.

SECTION 01 82 00

DEMONSTRATION AND TRAINING

PARTI- 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

- 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 01 82 00

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 startup 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 startup 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 s**hall 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 predemonstration 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 **Contractor**s, 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.
 - The **Contractor** is responsible for scheduling and coordinating commissioning 1. The Contractor shall reimburse the University for the cost of activities. 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-Repeated back-checking: Commissioning issues are charging include: 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 backcharging.
 - 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 <u>example</u> 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. <u>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.</u>
- B. <u>Seasonal Testing:</u> 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

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PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of This Section Includes:
 - 1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements
 - 2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on the use of premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 013500 "Special Procedures" for general protection and work procedures for alteration projects.
 - 3. Section 017300 "Cutting and Patching" for cutting and patching procedures.
 - 4. Section 017419 "Construction Waste Management and Disposal" for recycling & disposal requirements.

1.2 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed.
- B. Remove: Detach items from existing construction and legally dispose of off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

1.3 MATERIALS OWNERSHIP

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

1.4 COORDINATION

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

1.5 SUBMITTALS

A. Action and Informational submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.

- 1. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental and life-safety protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.
- 2. Schedule of Selective Demolition Activities: Indicate the following:
 - a. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - b. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
 - c. Coordination for shutoff, capping, and continuation of utility services.
 - d. Use of elevator and stairs.
 - e. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- 3. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- 4. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 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.
 - 1. Before selective demolition, Owner will remove the following items:
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Universal Waste: Manage and dispose of universal waste per the requirements of the authorities having jurisdiction. Provide verification documentation when requested.
- E. Hazardous Materials:
 - 1. It is not expected that hazardous materials, other than universal waste, will be encountered in the Work.
 - a. Hazardous materials will be removed by Owner before start of the Work.
 - If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. 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.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 PEFORMANCE 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 ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
 - 2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographsand measured drawings. Comply with Section 013233 "Photographic Documentation."
 - 1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
 - 2. Photograph conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

- A. Temporary Shoring: 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.
- B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.

- 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. 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.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective operation.
- B. Existing Services/Systems to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. If disconnection of utilities and building systems will affect adjacent occupied pars of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the building.
 - 3. Demolish, and remove existing building systems, equipment, and components indicated 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. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:
 - a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
 - b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL

- A. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers with label indicating elements, quantity, and location where removed.
 - 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.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

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- 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, to minimize disturbance of adjacent surfaces. 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 24 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.

3.6 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 (19 mm) 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. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using powerdriven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

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

3.8 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.

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END OF SECTION 024119

SECTION 024126 SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
- 2. Disposal of materials.
- 3. Storage of removed materials.
- 4. Identification of utilities.
- 5. Salvaged items.
- 6. Protection of items to remain.
- 7. Relocate existing equipment to accommodate construction.

1.2 SCHEDULING

- A. Schedule work to coincide with new construction.
- B. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.3 COORDINATION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Coordinate demolition work with Owner.
- C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- D. Shut-down Periods:
 - 1. Arrange timing of shut-down periods of in-service panels with Owner. Do not shut down any utility without prior written approval.
 - 2. Keep shut-down period to minimum or use intermittent period as directed by Owner. Maintain life-safety systems in full operation in occupied facilities or provide notice minimum 3 days in advance.
- E. Identify salvage items in cooperation with Owner.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- C. Verify termination points for demolished services.

3.2 **PREPARATION**

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.
- B. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Make temporary connections to maintain service in areas adjacent to work area.
- C. Existing Telephone System: Maintain existing system in service.
- D. Existing Public Address System: Maintain existing system in service. Disable system only to make switchovers and connections. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION

- A. Demolition Drawings are based on field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.
- B. Contractor shall visit project site and verify all conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all work with other trades.
- C. Remove abandoned conduit, cabling, and associated supports, including abandoned conduit and cables above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces to match existing.
- D. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- E. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- F. Remaining Circuits and Equipment: Reinstall existing electrical installations disturbed. Certain existing electrical installations may be located in walls, ceilings or floors that are to be removed and are essential for the operation of other remaining installations. Where this condition occurs provide a new extension of original circuits, raceways, equipment, and outlets to retain service continuity. Installations shall be concealed in finished areas.
- G. Reconnect equipment being disturbed by renovation work and required for continuous service.
- H. Disconnect or shut off service to areas where electrical work is to be removed. Remove

electrical fixtures, equipment, and related switches, outlets, conduit, and wiring which are not part of final project.

- I. Install temporary wiring and connections to maintain existing systems in service during construction.
- J. Perform work on energized equipment or circuits with experienced and trained personnel.
- K. Remove, relocate, and extend existing installations to accommodate new construction.
- L. Repair adjacent construction and finishes damaged during demolition and extension work.
- M. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.
- N. Clean and repair existing equipment to remain or to be reinstalled.
- O. Protect and retain power to existing active equipment remaining.
- P. Cap abandoned empty conduit at both ends.
- Q. If removed devices are on walls or ceilings that are to remain, blank cover plates are to be installed on outlet boxes.

3.4 EXISTING PANELBOARDS

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.
- B. Tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS

- A. Remove and protect items indicated on Drawings to be salvaged and turn over to Owner.
- B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.
- 3.6 REUSABLE ELECTRICAL EQUIPMENT

- A. Carefully remove equipment, materials, or fixtures which are to be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

3.7 CLEANING

- A. Remove demolished materials as work progresses. Legally dispose.
- B. Keep workplace neat.
- C. Clean and repair existing materials and equipment which remain or are to be reused.
- D. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- 3.8 RECYCLABLE AND REUSABLE MATERIAL AND EQUIPMENT:
 - A. Contractor shall be responsible for recycling of all removed materials and equipment as part of this work. Materials shall be collected by a recognized and approved reuse and recycling center.
 - B. Recyclable and reusable material and equipment shall include but not limited to the following:
 - 1. Plastic lighting diffusers
 - 2. Ferrous metals
 - 3. Non-ferrous metals
 - 4. Fluorescent lamps and ballasts
- 3.9 PROTECTION OF FINISHED WORK
 - A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
 - A. Reinforcing steel for cast-in-place concrete.
 - B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

- A. Section 03 10 00 Concrete Forms and Accessories.
- B. Section 03 30 00 Cast-In-Place Concrete.
- C. Section 03 37 13 Shotcrete.

1.3 REFERENCE STANDARDS

- A. ACI 301 Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).
- B. ACI 318 Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2011.
- C. ACI SP-66 ACI Detailing Manual; American Concrete Institute International; 2004.
- D. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2015.
- E. ASTM A706/A706M Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 2014.
- F. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- G. AWS D1.4/D1.4M Structural Welding Code Reinforcing Steel; American Welding Society; 2011.
- H. CRSI (DA4) Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2009.
- I. CRSI (P1) Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; 2011.

1.4 SUBMITTALS

- A. See Division 1 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar sizes and material types, lengths, spacings and locations, and quantities of reinforcing steel; bar schedules, stirrup spacing, shapes of bent bars, spacing of bars, and types and location of splices. Include special reinforcement required at openings and flat slab shear reinforcing.

- 1. Coordinate placement of embedded items with rebar placement.
- 2. Coordinate and indicate provisions for construction access.
- 3. Do not reproduce construction documents for shop drawings.
- C. Manufacturer's Certificate: Submit to the special inspector certificates that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Product Data: Submit for approval bar supports, chairs, and rebar couplers.
- E. Reports: Submit to the special inspector certified copies of mill test report of reinforcement materials analysis.
- 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING
 - A. Store reinforcement in a manner that will prevent rusting or coating with grease, oil, dirt, and other objectionable materials.
 - B. Deliver reinforcement to the job site bundled, tagged and marked, using metal tags.
- 1.6 QUALITY ASSURANCE
 - A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, ACI SP-66, and ACI 318 in addition to applicable building code.
 - 1. Maintain one copy of each document on project site.
 - B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) for #7 and smaller bars.
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
- B. Reinforcing Steel: ASTM A 706/A 706M, Grade 60 (420) for #8 and larger bars and all bars to be welded. Permitted for bars #7 and smaller.
 - 1. Deformed low-alloy steel bars
 - 2. Unfinished.
- C. High Strength Reinforcing Steel: ASTM A 615/A 615M, Grade 75, where noted on drawings.
 - 1. Deformed low-alloy steel bars.
 - 2. Unfinished.
- D. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
 - 1. WWR Style: 4 x 8-W6 x W10 (102 x 203-MW39 x MW65).

2.2 REINFORCEMENT ACCESSORIES:

- A. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
- C. Bar Supports placed against ground: Precast concrete blocks not less than 3 inches square with embedded wires.
- D. Welding Electrodes: Conform to AWS D1.4.
- E. Mechanical Couplers: Type 2 per ACI-318 with current ICC or IAPMO evaluation report.
 - 1. Manufacturers:
 - a. Headed Reinforcement Corporation (HRC); www.hrc-usa.com.
 - b. Erico; www.erico.com.
 - c. Dayton Superior; www.daytonsuperior.com.
 - d. Or equal.
 - 2. Couplers at formed construction joints may be
 - a. Lenton Form Saver by Erico.
 - b. HRC 520/525 Form Protector by HRC
 - c. D51A DBR Form Saver by Dayton.
 - d. Or equal.
- F. T-Headed Reinforcement: In compliance with ACI 318, Section 12.6 and with current ICC or IAPMO evaluation report.
 - 1. Manufacturers:
 - a. Headed Reinforcement Corporation (HRC); www.hrc-usa.com.
 - b. Erico; Product: www.erico.com.
 - c. Or approved equivalent.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) Manual of Standard Practice, ACI SP-66 - ACI Detailing Manual, ACI 318, and ACI 301.
- B. Welding of reinforcement is permitted only where indicated on drawings. Perform welding in accordance with AWS D1.4.
- C. Mechanical couplers may be substituted for contact lap splices provided concrete cover and bar spacing requirements are met and when approved by SEOR.
- D. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 - 1. Stagger splice locations so that no more than 50% of the bars are spliced at a section.
 - 2. Locations of splices subject to approval by University's Representative.

2.4 SOURCE QUALITY CONTROL

A. An independent testing agency will perform source quality control review, as specified in Division 1.

- B. Review mill test reports containing tensile and bend tests for type and grade of reinforcing steel.
- C. Weld Metal and Procedures: Review the following for conformance:
 - 1. Certificate of Compliance for weld metals used in work.
 - 2. Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR).
 - 3. Welder Certifications and re-qualification tests.
- D. Visually inspect 100% of shop welding.
 - 1. Butt Joint Welds: Perform radiographic examinations on 100 percent of welds.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position by more than the tolerances set forth in ACI 301.
- B. Do not displace or damage vapor barrier or water proofing membrane.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as indicated on drawings.
- E. Clean reinforcement of loose rust and mill scale, oil, grease, earth, ice, cement splatter and other materials which reduce or prevent bond with concrete.
- F. Set wire ties so ends are directed into concrete, away from concrete surfaces.
- G. Welding:
 - 1. For existing bars to be welded, Contractor to perform chemical analysis to demonstrate compliance with AWS D1.4.
 - 2. Welding shall not be done on or within two bar diameters of any bent portion of a bar.
 - 3. Welding of crossing bars is not permitted.
 - 4. Protect adjacent reinforcement against arc strikes during welding.
- A. Do not bend or realign reinforcement after being embedded in hardened concrete.
 - 1. Obtain approval from SEOR for bar repairs.

3.2 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Division 1, will inspect installed reinforcement for conformance to contract documents before concrete placement.
- B. Visually inspect 100% of field welding.
 - 1. Butt Joint Welds: Perform radiographic examinations on 100 percent of welds.
 - 2. All other welds: Perform magnetic partical testing on at least 25 percent of welds. For each weld

found to be defective, test 100 percent of the welds until 5 consecutive welds are found to have no defects.

- C. Visually Inspect 100 percent of mechanical coupler installations.
- D. Inspect placement, location, splices, spacing, size, cover and type of reinforcement for conformance with the contract documents.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
 - A. Elevated concrete slabs.
 - B. Floors and slabs on grade.
 - C. Concrete foundations.
 - D. Concrete walls, columns and beams.
 - E. Exposed concrete walls.
 - F. Joint devices associated with concrete work.
 - G. Miscellaneous concrete elements, including equipment pads and curbs.
 - H. Concrete curing.
- 1.2 RELATED REQUIREMENTS
 - A. Section 03 10 00 Concrete Forms & Accessories: Forms and accessories for formwork.
 - B. Section 03 20 00 Concrete Reinforcement.
- 1.3 REFERENCE STANDARDS
 - A. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).
 - B. ACI 301 Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).
 - C. ACI 302.1R Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
 - D. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
 - E. ACI 304.2R Placing Concrete by Pumping Methods; American Concrete Institute International;1996 (Reapproved 2008).
 - F. ACI 308R Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
 - G. ACI 318 Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
 - H. ASTM C31/C31M Standard Practice for Making and Curing Concrete Test Specimens in the Field;

2015.

- I. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2013.
- J. ASTM C39/C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.
- K. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete; 2015.
- L. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
- M. ASTM C143/C143M Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- N. ASTM C150/C150M Standard Specification for Portland Cement; 2012.
- O. ASTM C173/C173M Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- P. ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- Q. ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete; 2013.
- R. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.
- S. ASTM C685/C685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- T. ASTM C979/C979M Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- U. ASTM C1107/C1107M Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- V. ASTM C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures; 2014.
- W. ASTM E1155 Standard Test Method for Determining F (F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
- X. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.
- 1.4 SUBMITTALS
 - A. See Division 1 Administrative Requirements, for submittal procedures.
 - B. Product Data: Submit manufacturer's data on manufactured products, curing material, slab treatments, evaporation reducing compound and joint fillers showing compliance with specified requirements.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

- C. Certified Mix Design: Submit for each type and strength of concrete, at least 4 weeks prior to placement.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 Concrete Quality, Mixing and Placing.
 - 3. Include results of testing or test data used to establish mix proportions. This is to include unit weight, slump, shrinkage, and compression test reports. Mix designs to be prepared, stamped and signed by a Professional Engineer registered in the State of California.
 - 4. Submit certificates of compliance for materials of mix.
- D. Placement Schedule: Submit plans and schedule of concrete placement operations prior to commencement of work. Indicate locations of construction joints.
- E. Coordination Drawings: Submit drawings showing size and location of all penetrations and embedded items in cast-in-place structural elements.
- F. Construction Joint Layout: Submit drawings showing proposed construction joint locations.
- G. Mock-ups for exposed concrete.
- 1.5 QUALITY ASSURANCE
 - A. Perform work of this section in accordance with ACI 301 and ACI 318.
 - 1. Maintain one copy of each document on site.
 - B. Manufacturer Qualifications:
 - 1. A firm experienced in manufacturing ready mixed concrete products complying with ASTM C94/C94M and requirements for production facilities and equipment.
 - 2. Manufacturer to be certified according to the National Ready Mixed Concrete Association certification for ready mixed concrete production facilities.
 - C. Placement and Finishing contractor to have a minimum of five years' experience with similar types of projects.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Comply with requirements of Section 03 10 00.
- 2.2 REINFORCEMENT
 - A. Comply with requirements of Section 03 20 00.
- 2.3 CONCRETE MATERIALS
 - A. Cement: ASTM C 150, Type I Normal or Type II Moderate Portland type.

- 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33 and as modified below.
 - 1. Coarse Aggregates: Cleanness Value of not less than 75 as tested per California Test Method 227.
 - 2. Fine Aggregates: Sand Equivalent of not less than 75 as tested per California Test Method 217.
 - 3. Acquire all aggregates for entire project from same source.
- C. Lightweight Aggregate: ASTM C330
 - 1. Coarse Aggregate to be rotary kiln-expanded shale or clay having surface scaled by firing.
 - 2. Fine Aggregate to be a blend of natural sand and lightweight fines.
- D. Fly Ash: ASTM C618, Class F.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- G. Water: Clean and not detrimental to concrete.
- 2.4 ADMIXTURES
 - A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
 - B. Admixtures to be compatible with all other components in the mix.
 - C. Admixtures are to be included in the mix used to establish the mix design.
 - D. Air Entrainment Admixture: ASTM C260/C260M.
 - E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
 - F. Water Reducing Admixture: ASTM C494/C494M Type A.
 - G. Shrinkage Reducing Admixture:
 - 1. ASTM C494/C494M, Type S.
 - 2. Products:
 - a. Grace Construction Products; Eclipse 4500: www.na.graceconstruction.com.
 - b. Or equal. Submit product specification to University's Representative for approval.
 - H. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
 - 1. Products:
 - a. W.R. Meadows, Inc.; ADI-CON CW Plus: www.wrmeadows.com.
 - b. Xypex Chemical Corporation; XYPEX Admix C-500: www.xypex.com.
 - c. Or equal. Submit product specification to University's Representative for approval.
- 2.5 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier: Multi-layer plastic extrusion or equivalent, complying with ASTM E 1745, Class A, 0.38mm (15mil) or greater; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
 - 1. Permeance: 0.01 perms [grains/(ft2 x hr x inHg)] maximum as tested in accordance with ASTM E 1745 Section 7. Provide independent testing data showing compliance.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
 - 3. Products:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15: www.fortifiber.com.
 - b. Stego Industries, LLC: www.stegoindustries.com.
 - c. W.R. Meadows, Inc.; PERMINATOR Class A 15 mils (0.38mm): www.wrmeadows.com.
 - d. Or equal. Submit product specification to University's Representative for approval.

B. Rock Base:

- 1. Interior slabs-on-grade: Free draining, clean crushed rock or gravel conforming to Caltrans Class 1, Type A permeable material
- C. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. ASTM C1107/C1107M; Grade A, B, or C.
 - 2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa).
 - 3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).
- D. Repair Mortar:
 - 1. ASTM C1107/C1107M; Grade A, B, or C.
 - 2. Minimum Compressive Strength at 24 Hours, ASTM C29/C39M: 2,000 pounds per square inch (13.7 MPa).
 - 3. Minimum Compressive Strength at 28 Days, ASTM C39/C39M: 6,500 pounds per square inch (48 MPa).
 - 4. Recommended products: Sikacrete 211 SCC Plus by Sika Corporation, or equal. Submit product specification to University's Representative for approval.

2.6 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 - 1. Use admixtures as necessary to produce concrete of a consistency that will allow thorough compaction of the concrete into corners and around reinforcing without excessive puddling, spading or vibration, and without permitting the materials to segregate or free water to collect on the surface. Produce dense and uniform concrete free from rock pockets, honeycomb and other irregularities.
 - 2. Contractor to review and approve the proposed concrete mix designs for compatibility with placing requirements to ensure that the concrete as designed can be placed in accordance with the Drawings and Specifications.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience, as specified in ACI 301. Mix design to be prepared by a licensed Professional Engineer.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Cements and aggregates to have a proven history of successful use together. Alternatively submit evidence satisfactory to University's Representative that aggregate will not react harmfully in presence of alkalis in cement.
- E. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on drawings.
 - 2. Fly Ash Content: Minimum 25 percent and maximum 50 percent of cementitious materials by weight.
 - 3. Calcined Pozzolan Content: Maximum 20 percent of cementitious materials by weight.
 - 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 - 5. Water-Cement Ratio: Maximum 45 percent by weight.
 - 6. Dry Unit Weight: Minimum 144 lbs per cubic foot and maximum of 150 lbs per cubic foot.
 - 7. Total Air Content: 6 percent maximum, determined in accordance with ASTM C 173/C 173M.
 - 8. Admixtures: High Range Water Reducer at contractor's option.
 - 9. Maximum Slump at point of placement: 4 inches (100 mm).
 - a. Maximum Slump With Water Reducing Admixture: 8 inches (200 mm).
 - 10. Minimum Slump at point of placement: 1 inch (25 mm)
 - 11. Maximum Aggregate Size: 1 inch (40 mm).
 - 12. Drying Shrinkage:
 - a. Typical: Maximum 0.050 percent unless otherwise indicated.
 - b. Slabs-on-Grade and Suspended Slabs: Maximum 0.045 percent.
 - c. Shrinkage Reducing Admixture: Provide as required to attain maximum drying shrinkage when adequate shrinkage data for concrete mix design is not available.
- F. Patching Mortar: Mix in proportions by volume of one-part cement to two parts water. Substitute white cement for part of cement as necessary to produce color matching surrounding concrete.

2.7 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- 2.8 SOURCE QUALITY CONTROL
 - A. An independent testing agency will perform source quality control review, as specified in Division 1.
 - B. Review mix designs and certificates of compliance for materials Contractor proposes to use.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. A. Verify lines, levels, and dimensions before proceeding with work of this section.
- 3.2 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Protect finished surfaces adjacent to concrete-receiving places.
- D. Roughen surfaces of previously placed and existing concrete to 1/4 inch (7 mm) amplitude by heavy sand-blasting, waterblasting or bush-hammering. Prior to receiving concrete, clean surfaces of dust and debris using compressed air or water.
- E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- G. Clean surfaces of reinforcement and forms previously coated with cementitious materials by wire brushing or other acceptable means.
- H. Thoroughly wet all concrete and wood forms before application of concrete. Do not allow free water to remain on the surface.
- I. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches (150 mm) and seal watertight by taping edges and ends.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify University's Representative not less than 48 hours prior to commencement of placement operations.
- D. Do not place concrete until testing agency has inspected reinforcing placement.
- E. Water may be added once to each truckload in the field provided the specified water-cement ratio is maintained.
- F. Ensure reinforcement, inserts, embedded parts, and formwork and subgrade will not be disturbed during concrete placement.
- G. Consolidate concrete in accordance with ACI 309.
- H. Maximum placement area for placing of concrete to be 10,000 square feet. Contractor to submit proposed construction joint locations.
- I. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.
- 3.4 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for conformance to specified tolerances.
- B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
 - 1. Exposed to View and Foot Traffic: F(F) of 35; F(L) of 25.
 - 2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15.
 - 3. Under Carpeting: F(F) of 25; F(L) of 20.
 - 4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25.
- C. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.
- 3.5 CONCRETE FINISHING
 - A. Drypack surface defects, including tie holes, immediately after removing formwork.
 - B. Finish concrete surfaces to match existing.
 - C. Exposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height. Provide smooth rubbed finish. Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - D. Exposed concrete finishes shall be sealed (See Division 7).
 - E. For exposed architectural concrete where appearance is important, formwork design submittals and mock-ups are required. Establish tolerances for finish surfaces acceptance with architect in preconstruction meeting.
 - F. Concrete Beams, Girders, Walls, and Columns: Smooth formed.
 - G. Concealed Concrete Surfaces: Rough Formed
 - H. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows, unless otherwise noted on architectural drawings:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include ceramic tile with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, thin set ceramic tile, and fluid applied waterproofing.
 - 3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
 - a. Chemical Hardener: After slab has cured, apply water-diluted hardener in three coats per manufacturer's instructions.
 - 4. Float surfaces that will be left exposed in non-public areas

3.6 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than 7 days.
- C. Formed Surfaces: Cure by moist curing with forms in place. Provide curing for remainder of curing period after form removal.
- D. Surfaces Not in Contact with Forms:
 - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 - 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
 - b. Spraying: Spray water over floor slab areas and maintain wet.
 - c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
 - 3. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches (75 mm) and seal with waterproof tape or adhesive; secure at edges.
 - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
 - c. Liquid curing compounds are not acceptable for use on the mat slab or floor slabs.

3.7 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Division 1.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Provide full time special inspection during concrete placement.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 150 cu yd (114 cu m) or less of each class of concrete placed in any one day. 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

- G. Concrete Temperature: Test hourly when air temperature is 40F (4C) and below, and when 80F (27C) and above; and each time a set of compression test specimens is made.
- H. Review the ticket of each batch of concrete delivered to the site for conformance.
- I. Verify proper curing procedure and applications at initial curing and final curing stages.
- J. Verify within 72 hours after placement that floor tolerances are within the limits specified herein.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Where deficiencies are noted, the testing agency or Contractor to report defective concrete in writing to University's Representative within 24 hours.
- C. Repair or replacement of defective concrete will be determined by the University's Representative. The cost of additional testing, repair and design services to be borne by Contractor when defective concrete is identified.
- D. Contractor to submit repair of defective concrete within 2 days of discovery.
- E. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of University's Representative for each individual area.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Cold-formed steel framing
 - B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 ACTION SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For the following:
 - 1) Cold-formed steel framing materials.
 - 2) Vertical deflection clips.
 - 3) Single deflection track.
 - 4) Double deflection track.
 - 5) Drift clips.
 - 6) Post-installed anchors.
 - 7) Power-actuated anchors.
 - 8) Sill sealer gasket.
 - b. Delegated Design Submittal: For cold-formed steel framing.
 - c. Qualification Data: For testing agency.
 - d. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.
 - e. Product Certificates: For each type of code-compliance certification for studs and tracks.
 - f. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1) Steel sheet.
 - 2) Expansion anchors.
 - 3) Power-actuated anchors.
 - 4) Mechanical fasteners.
 - 5) Vertical deflection clips.
 - 6) Horizontal drift deflection clips
 - 7) Miscellaneous structural clips and accessories.
 - g. Research Reports: For nonstandard cold-formed steel framing, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- B. Closeout Submittals

1. Record Documents: For cold-formed metal framing, using shop drawings as a base drawing and indicating installed conditions including any changes to the original shop drawings.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Cold-Formed Steel Framing Design Standards: Unless more stringent requirements are indicated, framing complies with AISI S100, AISI S200, and AISI S240.
- C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with AISI S200 and AISI S240 for conditions indicated.
- B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
- C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60 (Z180).

2.3 ANCHORS, CLIPS, AND FASTENERS

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- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on [ICC-ES AC01] [ICC-ES AC193] [ICC-ES AC58] [or] [ICC-ES AC308] as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: [Torque-controlled expansion anchor] [Torque-controlled adhesive anchor] [or] [adhesive anchor].
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
 - Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1 (A1)] [Group 2 (A4)] stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.4 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B[or SSPC-Paint 20.
- B. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.5 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

- 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
- 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track or the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- 3.3 Install sill sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.4 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-toline joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

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- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.5 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed coldformed metal framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Miscellaneous framing and countertop supports.

1.2 COORDINATION

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

1.3 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For the following:
 - 1) Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2) Fasteners.
 - 3) Shop primers.
 - 4) Shrinkage-resisting grout.
 - 5) Slotted channel framing.
 - b. Welding certificates.
 - c. Research Reports: For post-installed anchors.
 - 2. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - a. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.

1.4 QUALITY ASSURANCE

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

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

- A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- B. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099123 Interior Painting,"

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

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- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 STEEL AND IRON FINISHES

- A. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with as specified in Section 099123 "Interior Painting",

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for [ceiling hung toilet partitions] operable partitions [overhead doors] [and] [overhead grilles] securely to and rigidly brace from building structure.
- C. Anchor shelf angles securely to existing construction with expansion anchors.

3.3 REPAIRS

- A. Touchup Painting:
 - 1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting.", Section 099123 "Interior Painting", or Section 099600 "High-Performance Coatings".

END OF SECTION 055000

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Cabinet hardware and accessories.
 - 3. Miscellaneous materials.
 - B. Related Requirements:
 - 1. Section 123661.16 "Solid Surfacing Countertops."

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, backing, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Coordinate keying for cabinet door and drawer lock with Owner.
 - 1. Schedule keying conference prior to installation of locks.

1.3 SUBMITTALS

- A. Action and Informational submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:

b.

- a. For each type of product.
 - Product Certificates: For the following:
 - 1) Composite wood products.
 - 2) Thermally fused laminate panels.
 - 3) High-pressure decorative laminate.
 - 4) Glass.
 - 5) Adhesives.
- 2. Shop Drawings:
 - a. Include plans, elevations, sections, and attachment details.
 - b. Show large-scale details.
 - c. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - d. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

1.4 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.5 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.

1.6 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 (16 and 32 deg C) 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.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
- B. Architectural Woodwork Standards Grade: Premium.
- C. Type of Construction: Frameless.
- D. Door, and Drawer Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings or approved equal from the following manufacturers:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Panolam Industries International, Inc.
 - d. Wilsonart International; Div. of Premark International, Inc.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGL.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: Grade HGL, ABS, or PVC edge banding, 1.0 mm thick, matching laminate in color, pattern, and finish.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:

- 1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.
 - a. Edges of Plastic-Laminate Shelves: ABS or PVC edge banding, 1.0 mm thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermally Fused Laminate Panel Shelves: ABS, PVC, or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
- 2. Drawer Sides and Backs: Thermally fused laminate panels with ABS, PVC, or polyester edge banding.
- 3. Drawer Bottoms: Thermally fused laminate panels.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. 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.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

- A. General: 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.
- 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. Moisture Resistant Particleboard: ANSI A208.1, Grade M-2, CARB NAF, MR10.
 - 2. Plywood: DOC PS 1

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
 - 1. Manufacturer: Blum or equal.
 - 2. Finish: Satin Stainless Steel
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 120 to 135 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal 5 inches (127 mm) long, 1-5/16 inches (33.4 mm) deep, and 5/16 inch (8 mm) in diameter.
- D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; heavy duty with shelf rests, B04081.
- F. Heavy Duty Shelf Rests: ANSI/BHMA A156.9, B04013;
 - 1. Metal with bottom hole for attaching shelf.
- G. Drawer Slides: ANSI/BHMA A156.9.

- 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted.
 - a. Type: Full overtravel extension.
 - b. Material: Zinc-plated ball bearing slides.
 - c. Motion Feature: Self-closing mechanism.
 - d. Manufacturer: Accuride or equal.
- 2. For drawers less than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD100, 100 lb capacity.
- 3. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD200, 200 lb load capacity.
- 4. For computer keyboard shelves, provide Grade 1HD-100, 100 lb load capacity.
- 5. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200, 200 lb load capacity.

Η.

- I. Door Locks: ANSI/BHMA A156.11, E07121.
 - 1. Manufacturer: Olympus or equal.
- J. Drawer Locks: ANSI/BHMA A156.11, E07041.
 - 1. Manufacturer: Olympus or equal.
- K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Stainless Steel: ANSI/BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. 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.
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement, containing no added urea formaldehyde.
 - 1. Adhesive for Bonding Edges: Adhesive specified above for faces.
 - 2. Adhesives used Onsite:
 - Adhesives shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1 (2010) or Version 1.2 (2017) (also known as Specification 01350).
 - b. Adhesives shall also meet the following VOC limits .:
 - 1) Contact Adhesive: 80 g/L.
 - 2) Multi-Purpose Construction Adhesive: 70 g/L
 - 3) Panel Adhesive: 50 g/L
 - 4) Wood Glue: 30 g/L.
 - c. Follow more stringent local, regional, state and federal requirements where applicable

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Base Cabinets:

- 1. Loose toe kicks with plywood bases will be used.
- C. 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.
- D. 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.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."
 - 1. For glass in wood frames, secure glass with removable stops.
 - 2. For exposed glass edges, polish and grind smooth.

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 (3 mm in 2400 mm) 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 (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips or 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 semi-exposed surfaces.

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END OF SECTION 064116

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.2 ALLOWANCES

A. Concrete MVE-control systems are part of Moisture Vapor Emission Control Allowance. Refer to the Cover Sheet of the drawings.

1.3 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.4 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product.
 - b. Qualification Data: For Manufacturer and Installer.
 - c. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - d. Preinstallation testing reports.
 - e. Sample Written Warranty
 - 2. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- 1.6 Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.

- 1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
- 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
- 3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

1.9 WARRANTY

- A. Warranty: Manufacturer's standard written warranty statement and all pre-installation warranty documents required to fill out in accordance with manufacturer's warranty.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
 - 2. Warranty Tranferability: Must be transferable to a new owner at any time during its duration.
 - 3. Warranty Coverage: Must include the following:
 - a. Removal of old system.
 - b. New epoxy system.
 - c. New flooring to match the original
 - d. Labor.
 - e. Materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
 - 1. Relative Humidity: Maximum 100 percent when tested according to ASTM F2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum .06 perm (3.45 ng/Pa x s x sq. m) when tested according to ASTM E96/E96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D7234.
- D. Low-emitting Materials: MVE-control material applied onsite, inside the weatherproofing membrane of the building shall comply with the following:
 - 1. All products shall be compliant with one of the following:
 - a. California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - b. Labelled Emicode EC1^{Plus.}

2.2 MANUFACTURERS

- A. Subject to requirements, the moisture control system, which may be incorporated into the work, shall be the product of a single manufacturer, no substitutions.
 - 1. Approved products:

- a. Koster VAP I 2000 Zero VOC System.
- b. Ardex MC Rapid.
- c. Mapei Planiseal VS
- d. Uzin PE 460

2.3 MVE-CONTROL SYSTEM

- A. MVE-Control System: ASTM F3010-qualified, fluid-applied, two-component, epoxy-resin, membraneforming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
 - 1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
 - Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.
 - 3. Low-emitting materials: Provide moisture control products with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D. Follow more stringent local, regional, state and federal requirements where they exist.

2.4 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C109/C109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's gypsum or hydraulic cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Preinstallation Testing:
 - 1. Testing Agency: Engage a qualified testing agency to perform tests.
 - 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Notify Owner and Architect of testing results to determine if installation is required. If required, install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
 - 3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in the first test area and one test in each additional installation area and with test areas evenly spaced in installation areas.

- a. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
- 4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.
 - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
 - 1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
 - 2. Shot blasting is only to be provided if required by manufacturer's written instructions.
 - a. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
 - 3. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 - 4. Fill surface depressions and irregularities with patching and leveling material.
 - 5. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
 - 6. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
 - 7. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.
- C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

- A. Install MVE-control system according to ASTM F3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
 - a. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.

- 1. Verify that surface preparation meets requirements.
- 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
- 3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.
- 4. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END SECTION 090561.13

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Framing systems.
 - 2. Suspension systems.
 - 3. Grid suspension systems.
 - B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior nonload-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product.
 - b. Product Certificates: For each type of code-compliance certification for studs and tracks.
 - c. Evaluation Reports: For high-strength steel studs and tracks, firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Supreme Steel Framing System Association.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (239 Pa).
- D. Vertical Deflection: For ceiling assemblies, limited to 1/360 of the ceiling span based on vertical loading of 5 lbf/sq. ft. (239 Pa).
- E. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- F. Design Loads: As indicated on <u>architectural structural Drawings drawings</u> or 5 lbf/sq. ft. (239 Pa) minimum as required by the <u>C</u>IBC.
- G. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection as indicated on <u>Destructural drawings</u>.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 for conditions indicated.
 - 1. Steel Sheet Components: Comply with AISI S220 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120); or coating with equivalent corrosion resistance. Galvanealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
 - 1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection and not less than 0.0329 inch (0.836 mm)(20ga).
 - 2. Depth: As indicated on Drawings.
- C. High Strength Steel Studs and Tracks: Roll-formed with surface deformations to stiffen the framing members.
 - 1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection and not less than 0.0180 inch (0.457 mm)(25ga).
 - 2. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch (51-mm) minimum vertical movement.
 - 2. Single Long-Leg Track System: Top track with 2-inch-(51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - 3. Double-Track System: Top outer tracks, inside track with 2-inch-(51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- F. Steel One-Piece Headers and Jamb Studs: Manufacturer's standard C-shape used as header beam and jamb studs, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Basis of Design: ClarkDietrich RedHeader PRO.
 - 2. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection and not less than 0.033 inch (0.84 mm)(20ga).
 - 3. Flange Width: As indicated on Drawings.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.054 inch (1.37 mm)(16ga).
- H. Cold-Rolled Channel Bridging: Steel, 0.054-inch (1.37-mm)(16ga) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch-(1.72-mm-)(14ga) thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels:
 - 1. Minimum Base Metal Thickness: 0.018 inch (0.46 mm)(25ga).
 - 2. Depth: As indicated on Drawings.
- J. Resilient Furring Channels: 1/2-inch-(13-mm-) deep, steel sheet members designed to reduce sound transmission.

0. Configuration: Asymmetrical or hat shaped.

- L_J_ Cold-Rolled Furring Channels: 0.054-inch (1.34-mm)(16ga) uncoated-steel thickness, with minimum 1/2inch- (13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.84 mm)(20ga).
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-(1.59-mm-)(16ga) diameter wire, or double strand of 0.048-inch-(1.21-mm-)(18ga) diameter wire.
- M.K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 3/4 inch (19 mm), minimum uncoated-metal thickness of 0.018 inch (0.46 mm)(25ga), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-(1.59-mm-)(16ga) diameter wire, or double strand of 0.048-inch-(1.21-mm-)(18ga) diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58, or AC308 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor, torque-controlled, adhesive anchor, or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
 - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
 - 2. Powder-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16-inch (4.12-mm)(8ga) in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.054 inch (1.37 mm)(16ga) and minimum 1/2-inch-(13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.054-inch (1.37-mm)(16ga) uncoated-steel thickness, with minimum 1/2inch-(13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 - 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm)(20ga).
 - b. Depth: As indicated on Drawings.
 - 3. High-Strength Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Metal Thickness: 0.0180 inch (0.457 mm)(25ga).
 - b. Depth: As indicated on Drawings.
 - 4. Hat-Shaped, Rigid Furring Channels: 7/8 inch (22 mm) deep.
 - a. Minimum Base Metal Thickness: 0.018 inch (0.46 mm)(25ga).
 - 5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.

2.4 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
 - After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
 - 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

- A. Install framing system components in accordance with spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 24 inches (610 mm) o.c. unless otherwise indicated.
 - 2. Multilayer Application: 24 inches (610 mm) o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powderdriven fasteners spaced 24 inches (610 mm) o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Zshaped furring members spaced 24 inches (610 mm) o.c.
 - Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
 - At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches(305 mm) from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLATION OF SUSPENSION SYSTEMS

- A. Install suspension system components in accordance with spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches (1219 mm) o.c.
 - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
 - 3. Furring Channels (Furring Members): 24 inches (610 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

- 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 5. Do not attach hangers to steel roof deck.
- 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support

3.6 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.7 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Texture finishes.
 - B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data: For the following:
 - a. Gypsum wallboard.
 - b. Gypsum board, Type X.
 - c. Mold-resistant gypsum board.
 - d. Water-resistant gypsum backing board.
 - e. Interior trim.
 - f. Joint treatment materials.
 - g. Sound-attenuation blankets.
 - h. Acoustical sealant.
 - i. Textured finishes.

1.3 DELIVERY, STORAGE AND HANDLING

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

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

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

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTME90 and classified in accordance with ASTME413 by an independent testing agency.
- C. Low-emitting Materials: All interior gypsum board products shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. SCS Indoor Advantage Gold certified.
 - 3. UL Greenguard Gold certified.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
- C. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Coated Glass-Mat Interior Gypsum Board: 10-by-10 glass mesh.
 - 3. Exterior Gypsum Soffit Board: Paper.
 - 4. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 5. Tile Backing Panels: As recommended by panel manufacturer.

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- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use settingtype taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.5 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Low-Emitting Materials: Insulation shall comply with one of the following requirements:
 - a. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - b. SCS Indoor Advantage Gold certified.
 - c. UL Greenguard Gold certified.
- D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

2.6 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
 - 1. Texture: Match adjacent existing finish

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- Ε.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 12 sq. ft. (1.05 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical and horizontal surfaces unless otherwise indicated.
 - 2. Flexible Type: Apply in double layer at curved assemblies.
 - 3. Foil-Backed Type: As indicated on Drawings.
 - 4. Abuse-Resistant Type: As indicated on Drawings.
 - 5. Mold-Resistant Type: At wet areas to be painted and as indicated on Drawings.
 - 6. Type C: As indicated on Drawings.
 - 7. Glass-Mat Interior Type: As indicated on Drawings.

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- 8. Acoustically Enhanced Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations and install LC bead trim,
 - 2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TILE BACKING PANELS

A. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in accordance with manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use where indicated.

3.7 FINISHING OF GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

- a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- 5. Level 5: At all panel surfaces to receive wallcovering unless otherwise noted. Additional locations as indicated on drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.8 APPLICATION OF TEXTURE FINISHES

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

3.9 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile.
 - 2. Glazed wall tile.
 - 3. Waterproof membranes.
 - 4. Crack isolation membranes.
 - 5. Setting material.
 - 6. Grout material.

B. Related Requirements:

- 1. Section 071326 "Self-Adhering Sheet Waterproofing" at floor drains.
- 2. Section 079200 "Joint Sealants" for sealing of movement joints in tile surfaces.
- 3. Section 092900 "Gypsum Board" for tile backing panels.
- 4. Section 090561.13 "Moisture Vapor Emission Control."

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches (381 mm) or longer.
- D. Module Size: Nominal tile size including joint width indicated.

1.3 SUBMITTALS

- 1. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - a. Product Data:
 - 1) For each type of product, including VOC content of all adhesive, mortar, grout, liquid membranes and sealants.
 - 2) Qualification Data: For Installer.
 - 3) Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
 - 4) Product Certificates: For each type of product.
 - 5) Product Test Reports: For tile-setting and -grouting products.
 - b. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - c. Samples:
 - 1) 6 by 6-inch (152 by 152 mm) minimum units of each type and composition of tile and for each color and finish required.
 - 2) Full-size units of each type of trim and accessory for each color and finish required.
 - 3) Metal edge strips in 6-inch lengths.
- 2. Closeout Submittals
 - a. Maintenance Data: For ceramic tile to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications, one or more of the following:
 - 1. Installer is a Five-Star member of the National Tile Contractors Association (NTCA) or a Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
 - 2. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of membranes and large format tile.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
 - 2. Obtain underlayment from manufacturer of setting and grouting materials.
- C. Accessory Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Thresholds.

093013 -2 CERAMIC TILING 10/2021 Edition 2. Backer units.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for properties, ratings, types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in submerged, exterior, or interior wet areas, do not use backor edge-mounted assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated with a record of successful in-service performance.

2.3 PORCELAIN TILE

- A. Porcelain Tile Unpolished.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated on Drawings.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Dynamic Coefficient of Friction for flooring: Not less than 0.42.
 - 4. Size, Color, and Pattern: As indicated on Drawings.
 - 5. Grout Color: As selected by Architect from manufacturer's full range.

2.4 GLAZED WALL TILE

- A. Glazed Wall Tile
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated on Drawings.
 - 2. Size, Color, and Pattern: As indicated on Drawings.
 - 3. Grout Color: As selected by Architect from manufacturer's full range.

2.5 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Fluid-Applied: Liquid-latex rubber or elastomeric polymer.
 - 1. Nominal Thickness: As required per ASTM A118.10 and A118.12.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; BlackTop.
 - b. C-Cure; Pro-Red Waterproofing Membrane 963.
 - c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
 - d. TEC, an H. B. Fuller Company; HydraFlex Waterproofing Crack Isolation Membrane.

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Fluid-Applied: Liquid-latex rubber or elastomeric polymer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; BlackTop.
 - b. C-Cure; Pro-Red Waterproofing Membrane 963.
 - c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane or FractureFree Crack Prevention Membrane.
 - d. Merkrete Systems, Parex USA, Inc.; Fracture-Guard 5000.
 - e. TEC, an H. B. Fuller Company; HydraFlex Waterproofing Crack Isolation Membrane.

2.7 SETTING MATERIALS

- A. Low-emitting Materials: Setting material applied onsite, inside the weatherproofing membrane of the building shall comply with the following:
 - 1. Setting materials shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Ceramic tile adhesives shall also meet the following VOC limits:
 - a. Ceramic Tile Adhesive: 65 g/L.
 - b. Follow more stringent local, regional, state and federal requirements where applicable.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

- A. Low-emitting Materials: Grouting material applied onsite, inside the weatherproofing membrane of the building shall comply with the following:
 - 1. Grouting materials shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Ceramic tile adhesives shall also meet the following VOC limits:
 - a. Ceramic Tile Adhesive: 50 g/L.
 - b. Follow more stringent local, regional, state and federal requirements where applicable.
- B. High-Performance Tile Grout: ANSI A118.7.
 - 1. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
- C. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less. Follow more stringent local, regional, state and federal requirements where they exist.
 - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.
- B. Metal Edge Strips: As indicated on Drawings.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout, with a VOC content of 100 g/L or less. Follow more stringent local, regional, state and federal requirements where they exist.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify concrete substrates for tile floors installed with adhesives, bonded mortar bed, or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind stone tile has been completed.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:

- 1. For tile shorter than 15 inches (381 mm), confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. (6.4 mm in 3 m) from the required plane, and no more than 1/16 inch in 12 inches (1.5 mm in 300 mm) when measured from tile surface high points.
- 2. For large format tile, tile with at least one edge 15 inches (381 mm) or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. (3 mm in 3 m) from the required plane, and no more than 1/16 inch in 24 inches (1.5 mm in 609 mm) when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

- A. Install panels and treat joints in accordance with Section 092900 "Gypsum Board."
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - 1. Add materials, water, and additives in accurate proportions.
 - 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile swimming pool decks.
 - c. Tile floors in laundries.
 - d. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - e. Tile floors consisting of rib-backed tiles.
 - 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 - 4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 - 5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 - 6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

- 7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Metal Flooring Transitions: Install as indicated on Drawings.
- H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with floor-sealer manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Porcelain Tile Installation at **Toilet Rooms**: TCNA F121 and ANSI A108.1C: Cement mortar bed on waterproof/crack isolation membrane.
 - a. Ceramic Tile Type: **PT1**.
 - b. Bond Coat for Cured-Bed Method: Medium-bed, modified dry-set mortar.
 - c. Membrane: Fluid-applied waterproof/crack isolation membrane with 6" reinforcing fabric mesh at all joints and corners. Membrane to continue 6" A.F.F.
 - d. Grout: Water-cleanable epoxy grout.
- B. Interior Wall Installations, Metal Studs:
 - 1. Porcelain Tile Installation at **Toilet Rooms**: TCNA W245 or TCNA W248: Thinset mortar over waterproofing membrane on glass-mat, water-resistant gypsum backer board.
 - a. Ceramic Tile Type: **PT2, CT1**.
 - b. Thinset Mortar: Modified dry-set mortar.

- Membrane: Fluid-applied waterproof/crack isolation membrane with 6" reinforcing fabric mesh at all joints and corners. Membrane to continue 6" A.F.F. of tile wainscot. Grout: High-performance sanded grout. c.
- d.

END OF SECTION 093013

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Acoustical panels.
 - 2. Metal suspension systems.
 - 3. Metal edge moldings and trim.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data
 - a. For each type of product indicated, including documentation of compliance with performance requirements.
 - b. Qualification Data: For testing agency.
 - c. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - d. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- B. Field quality-control reports.
- C. Closeout Submittals
 - 1. Maintenance Data: For finishes to include in maintenance manuals.

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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.
 - 4. Impact Clips: Equal to 2 percent of quantity installed.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling Systems: Obtain each type of acoustical ceiling panel and its supporting suspensions system from single source form single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A in accordance with ASTM E1264.
 - 2. Smoke-Developed Index: 450 or less.
- C. Low-emitting Materials: All acoustical panel ceilings shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. SCS Indoor Advantage Gold certified.
 - 3. UL Greenguard Gold certified.

2.3 ACOUSTICAL PANELS

- A. Acoustic Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated on Drawings or comparable product approved by Architect.
- C. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 HEAVY DUTY METAL SUSPENSION SYSTEM

- A. Metal Suspension System Standard: Provide manufacturer's standard heavy duty direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide products as indicated on Drawings or comparable product approved by Architect.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Cast-in-place anchors.
 - b. Corrosion Protection, Carbon-Steel: Components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at 3 times hanger design load (ASTMC 635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-(3.5-mm-) diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Hold-Down Clips: Manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- E. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels inplace during a seismic event.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or comparable product approved by Architect.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. Edge moldings to fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners, unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements:

- 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31 Class II, 0.010 mm or thicker.
- 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION OF ACOUSTIC PANEL CEILINGS

- A. Install acoustical panel ceilings in accordance with ASTM C636/C636M, seismic design requirements, manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure rod hangers to structure, including intermediate framing members, by attaching to inserts, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to castin-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

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- 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 6. Install hold-down seismic clips in areas indicated; space in accordance with panel manufacturer's written instructions, unless otherwise indicated.
 - a. Hold-Down Clips: Space 24 inches (610 mm) o.c. on all cross runners.
 - 7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI
 7.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completions, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustic panel ceiling hangers show compliance with requirements.
 - 1. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 units have passed consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers, anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 CLEANING

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

END OF SECTION 095113

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient floor accessories.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product indicated, including documentation of compliance with performance requirements.
 - b. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.
 - 2. Samples: For each type of product indicated and for each color, texture, and pattern required, in manufacturer's standard-size Samples but not more than 12 inches (300 mm) long.
- B. Closeout Submittals
 - 1. Maintenance Data: For resilient base and accessories to include in maintenance manuals.

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 (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following time 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 (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Low-emitting Materials: All resilient base and floor accessories shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. UL Greenguard Gold certified.
 - 3. Resilient Floor Covering Institute (RFCI) FloorScore certified.

2.2 THERMOSET RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style, Height, and Color: As indicated in the Drawings.
 - 2. Thickness: 0.125 inch (3.2 mm).
 - 3. Lengths: Coils in manufacturer's standard length.
 - 4. Inside and Outside Corners: Job formed.

2.3 RUBBER FLOOR TRIM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products indicated in the Drawings.
- B. Description: Rubber cove for coved resilient floor covering.
- C. Profile and Dimensions: As indicated.
- D. Colors and Patterns: As indicated.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Adhesives shall also meet the following VOC limits:
 - a. Resilient base adhesive: 50 g/L.
 - b. Follow more stringent local, regional, state and federal requirements where applicable.
- C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 (50.8 mm) inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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- 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. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare horizontal surfaces 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 manufacturer. Do not use solvents.
 - 3. Testing: Comply with Section 090561.13 "Moisture Vapor Emission Control" for testing.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are 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.
- E. 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 practicable 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. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 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 6 inches in length.

a. Cope corners to minimize open joints.

3.4 RESILIENT FLOOR TRIM ACCESSORY INSTALLATION

A. Comply with manufacturer's written installation instructions.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product 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 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 096513

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. PVC-free sheet flooring.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product indicated, including documentation of compliance with performance requirements.
 - b. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.
 - c. Qualification Data: For Installer.
 - 2. Shop Drawings: For each type of resilient flooring.
 - a. Include sheet floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - b. Show details of special patterns.
 - 3. Samples: For each exposed product and for each color, texture and pattern specified in manufacturer's standard size, but not less than 3 inch (75mm) square and not more than 12 inch (300mm) square sections.
 - a. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
 - b. Heat-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 (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
- B. Closeout Submittals
 - 1. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

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. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 m) for every 500 linear feet (152 m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.4 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. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.
- B. DELIVERY, STORAGE, AND HANDLING

1. 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 (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient sheet flooring during the following time 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 (13 deg C) or more than 95 deg F (35 deg C).
- 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 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Low-emitting Materials: All resilient sheet flooring shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Resilient Floor Covering Institute (RFCI) FloorScore certified.
 - 3. UL Greenguard Gold certified.

2.2 PVC-FREE SHEET FLOORING

- A. Products: Subject to compliance with requirements, provide product as indicated on Drawings.
- B. Sheet Width: As standard with manufacturer.
- C. Seamless-Installation Method: [As indicated on Drawings] [Heat welded] [Chemically bonded].
- D. Sizes, Patterns, and Colors: As indicated on Drawings.
- E. Seamless-Installation Method: As indicated on Drawings.
- F. Sizes, Patterns, and 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 manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring rolling loads and substrate conditions indicated.
 - 1. Adhesives shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Adhesives shall also meet the following VOC limits:
 - a. Resilient sheet flooring: 50 g/L, except 60 g/L for rubber flooring.
 - b. Follow more stringent local, regional, state and federal requirements where applicable.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: [As indicated] [As selected by Architect from manufacturer's full range].
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius, provided or approved by flooring manufacturer.
 - 2. Cap Strip: Square metal cap provided or approved by resilient sheet flooring manufacturer.
 - 3. Corners: Welded inside and outside corners.

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. Remove paint, marker, and other substances that may telegraph through resilient sheet flooring product using mechanical methods recommended by resilient sheet flooring manufacturer.
 - 4. Testing: Comply with Section 090561.13 "Moisture Vapor Emission Control" for testing.
- 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.
 - Chemically Bonded Seams: Comply with ASTM F693. Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated on the Drawings, up vertical surfaces. Support flooring at horizontal and vertical junction by cove strip. Butt at top against cap strip.
 - 1. Weld inside and outside corners. Sealant at joints will not be acceptable.

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.

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- 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, 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 096516

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Water-based finish coatings.
 - 3. Solvent-based finish coatings.
 - 4. Floor sealers and paints.
 - 5. Dry fall coatings.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - 3. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product. Include preparation requirements and application instructions.
 - 1) Include preparation requirements and application instructions.
 - 2) Include compliance with performance requirements.
 - b. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.
 - 2. Samples: For each type of topcoat product.
 - a. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - b. Step coats on Samples to show each coat required for system.
 - c. Label each coat of each Sample.
 - d. Label each Sample for location and application area.
- B. Closeout Submittals
 - 1. Maintenance Data: For painting to include in maintenance manuals.

1.3 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed, and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
- 1.4 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Dunn-Edwards Corporation Endura-coat, Endura-cat and/or Everest 50
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As indicated on Drawings.

2.3 PERFORMANCE REQUIREMENTS

- A. Low-emitting Materials: All interior paints and coatings applied onsite shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017) (also known as Specification 01350).
 - 2. UL Greenguard Gold certified.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction. For field applications that are inside the weatherproofing system, use paints and coatings that also comply with the following limits for VOC content.
 - 1. Interior Flat Paints and Coatings: 50 g/L.
 - 2. Interior Non-flat Paints and Coatings: 50 g/L.
 - 3. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
 - 4. Floor Coatings: 100 g/L.
 - 5. Sealers, Primers and Undercoater: 100 g/L.
 - 6. Specialty Primers: 100 g/L.
 - 7. Waterproofing Sealers: 100 g/L.

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2.4 PRIMERS

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 work.
- B. Maximum Moisture Content of Substrates: Measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. 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.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers 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.
 - 1. Remove paint, marker, and other substances that will show through floor sealer products using mechanical methods recommended by concrete floor sealer manufacturer.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items 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. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

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

3.5 CLEANING AND PROTECTION

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

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- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Epoxy Concrete Floor Sealer System, Clear:
 - a. First Coat: Matching topcoat.
 - b. Topcoat: Water-based epoxy concrete floor sealer.
 - 1) Benjamin Moore: V156 Moisture Tolerant Quick Set Epoxy Sealer, VOC 94g/L.
 - 2) Diamond Vogel: Kemiko Waterborne Fast Dry SS3700.
 - 3) PPG Paints: 98E-1 Series Aquapon Catalyzed Waterborne Epoxy, 26g/L.
 - Sherwin-Williams: ArmorSeal 33 Epoxy Primer, VOC <50g/L with ArmorSeal 650 SL/RC Epoxy <100g/L.
- B. Steel Substrates:
 - 1. Latex System:
 - a. Prime Coat: Factory-primer or Rust-inhibitive metal primer.
 - 1) Dunn-Edwards: Bloc-Rust Premium BRPR00 series.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior latex, Semi-Gloss.
 - 1) Dunn-Edwards: Enduracat ENPX50
 - 2) Dunn-Edwards: Endura-coat ENCT30
- C. Gypsum Board and Plaster Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Interior latex primer sealer.
 - 1) Dunn-Edwards: Inter-Kote IKPR00-1 Undercoater.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior latex, Eggshell.
 - 1) Dunn-Edwards: Suprema SPMA 40.
 - d. Topcoat: Interior latex, Semi-Gloss.
 - 1) Dunn-Edwards: Suprema SPMA 50.

END OF SECTION 099123

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Phenolic-core toilet compartments.
 - B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for supports that attach ceiling-hung compartments and floorand-ceiling-anchored compartments to overhead structural system.
 - 2. Section 092216 "Non-Structural Metal Framing" for blocking.
 - 3. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data: For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
 - 2. Shop Drawings: For toilet compartments.
 - a. Include plans, elevations, sections, details, and attachment details.
 - b. Show locations of cutouts for compartment-mounted toilet accessories.
 - c. Show locations of centerlines of toilet fixtures.
 - d. Show locations of floor drains.
 - e. Show overhead support or bracing locations.
 - f. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1) Include structural design calculations indicating compliance with specified structuralperformance requirements.
 - 3. Coordination:
 - a. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.
- B. Closeout Submittals
 - 1. Operation and Maintenance Data: For toilet compartments to include in maintenance manuals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: Two hinges with associated fasteners.
 - 2. Latch and Keeper: One latch and keeper with associated fasteners.
 - 3. Door Bumper: One door bumper with associated fasteners.
 - 4. Door Pull: One door pull with associated fasteners.

102113.17 -1 PHENOLIC-CORE TOILET COMPARTMENTS 10/2021 Edition 5. Fasteners: Ten fasteners of each size and type.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the USDOJ's ADA Standards for Accessible Design and ICC A117.1, and all state and local jurisdictional requirements for toilet compartments designated as accessible.
- C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

- A. Toilet-Enclosure Style: Overhead braced, Gap-Free.
- B. Urinal-Screen Style: Wall hung, floor anchored.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13mm-) thick panels.
- D. Urinal-Screen Construction: Matching panel construction.
- E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) (22ga) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- F. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) (22ga) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- G. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters or 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster.
- H. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- I. Phenolic Compartment Finish: One color and pattern in each room.

102113.17 -2 PHENOLIC-CORE TOILET COMPARTMENTS 10/2021 Edition 1. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Stainless steel.
 - 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM 26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls with leveling adjustment at bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet enclosures and 36-inch- (914-mm-) wide, outswinging doors with a minimum 32-inch- (813mm-) wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch (13 mm).
 - b. Panels or Screens and Walls: 1 inch (25 mm).
 - 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with fullheight brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - 4. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.17

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Cubicle Curtain support systems.
 - 2. Cubicle curtains.
 - B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product.
 - 1) For each type of curtain fabric indicated, include durability, laundry temperature limits, fade resistance, applied curtain treatments, and fire-test-response characteristics.
 - b. Product Schedule: For curtains and tracks. Use same designations indicated on Drawings.
 - 2. Shop Drawings: For curtains and tracks.
 - a. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 b. Include details of blocking for track support.
 - 3. Samples: For each type of product required, prepared on Samples of size indicated below.
 - a. Curtain Fabric: Not less than 10 inches (254 mm) square and showing complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 - b. Mesh Top: Not less than 10 inches (254 mm) square.
 - c. Curtain Track: Not less than 10 inches (254 mm) long.
 - d. Curtain Carrier: Full-size unit.
- B. Closeout Submittals
 - 1. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated, but no fewer than 10 units.
 - 2. Curtains: Full-size units equal to 10 percent of amount installed for each size indicated, but no fewer than 2 units.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Cubicle Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Laundering: Launderable to a water temperature of not less than 160 deg F (71 deg C).
 - 2. Flame Resistance: Provide fabrics identical to those that have passed NFPA 701 when tested by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CURTAIN SUPPORT SYSTEMS

- A. Extruded-Aluminum Curtain Track:
 - 1. Channel or I-beam style with manufacturer's standard wall thickness.
 - 2. Curved Track: Factory-fabricated, 12-inch-(305-mm-) radius bends.
 - 3. Finish: As indicated on Drawings.
- B. Curtain-Track Mounting: As indicated on Drawings.
- C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - 1. Suspended-Track Support: Not less than 5/8-inch-(16-mm-) square or 7/8-inch-(22.2-mm-) OD tube.
 - 2. End Stop: Removable with carrier hook.
- D. Curtain Roller Carriers: Two nylon rollers and nylon axle with steel hook.
- E. Exposed Fasteners: Stainless steel.
- F. Concealed Fasteners: Stainless steel.
- 2.3 CUBICLE CURTAINS
 - A. Basis-of-Design Product: See Drawings for standard disposable curtain information.

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

3.2 INSTALLATION

- A. Install tracks level and plumb, according to manufacturer's written instructions.
- B. For tracks of up to 20 feet (6.0 m) in length, provide track fabricated from 1 continuous length.
- C. Track Mounting: As indicated on Drawings.
 - 1. Surface-Track: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
- a. Mechanically fasten directly to finished ceiling with toggle bolts.
- b. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.
- c. Mechanically fasten to suspended ceiling grid with screws.
- d. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
- 2. Suspended-Track: Install track with manufacturer's standard tubular aluminum suspended supports at intervals and with fasteners recommended by manufacturer. Fasten supports to structure. Provide supports at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
- D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
 - 1. Provide one hinged loading unit for each bed.
- E. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
- F. Cubicle Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 102123

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Wall guards.
 - 2. Corner guards.
 - B. Related Sections:
 - 1. Section 087111 "Door Hardware" for metal and plastic protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For each type of product.
 - 1) Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
 - b. Product Certificates: For each type of handrail.
 - c. Material Certificates: For each impact-resistant plastic material, from manufacturer.
 - d. Material Test Reports: For each impact-resistant plastic material.
 - 2. Shop Drawings: For each type of wall protection showing locations and extent.
 - a. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.
- B. Closeout Submittals
 - 1. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 - a. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

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. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot- (2.4-m-) long units.
 - 2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two of each length unit used.
 - 3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside wellventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
 - 2. Keep plastic sheet material out of direct sunlight.
 - 3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guards in a horizontal position.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall 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.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall protection products of each type from single source from single manufacturer.
- B. PVC-free Plastic Paneling: Solid panels made from PETG or bio-based modified polylactide resin with flame retardant and integral color.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. CS Acrovyn, Construction Specialties, Inc.
 - b. InPro Corporation.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Low-emitting Materials: Wall protection shall comply with one of the following requirements:
 - 1. Compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. UL Greenguard Gold certified.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 WALL GUARDS

- A. Crash Rail: Heavy-duty, PVC-free assembly consisting of minimum 0.100-inch- (2.5-mm-) thick, continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

2.4 CORNER GUARDS

- A. Surface-Mounted, Resilient, Plastic Corner Guards: Manufacturer's standard, PVC-free assembly consisting of minimum 0.078-inch- (2.0-mm-) thick, snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

2.5 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. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. (800 J/m) of notch when tested according to ASTM D256, Test Method A.
- C. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.
- D. 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.
- E. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer.
 - 1. Adhesives shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (2017).
 - 2. Adhesives shall also meet the following VOC limits:
 - a. Impact-resistant Plastic Wall Protection Adhesive: 50 g/L.
 - b. Follow more stringent local, regional, state and federal requirements where applicable.

2.6 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.

2.7 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, fire rating, and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- 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 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.
 - 2. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
 - 3. Adjust end and top caps as required to ensure tight seams.
- D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

102600 -4 WALL AND DOOR PROTECTION 10/2021 Edition

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Public-use washroom accessories.
 - 2. Healthcare accessories.
 - 3. Hand-sanitizer dispensers.

B. Related Sections:

- 1. Section 088300 "Mirrors" for frameless mirrors.
- 2. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:

a.

- For each type of product indicated.
 - 1) Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2) Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3) Include electrical characteristics.
- b. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1) Identify locations using room designations indicated.
 - 2) Identify products using designations indicated.
- B. Closeout Submittals
 - 1. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Toilet-Compartment Occupancy-Indicator Systems: Manufacturer agrees to repair or replace toilet-compartment occupancy-indicator systems that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Material: As indicated on the drawings.

2.2 PERFORMANCE REQUIREMENTS

- 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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product approved by Architect.
- C. Toilet Tissue (Roll) Dispenser
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
 - 3. Mounting: Partition mounted serving two adjacent toilet compartments or Surface mounted as indicated on the drawings.
 - 4. Operation: Noncontrol delivery with theft-resistant spindle.
 - 5. Capacity: Designed for 4-1/2- or 5-inch-(114- or 127-mm-) diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- D. Combination Toilet Tissue Dispenser:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Description: Combination unit with double-roll toilet tissue dispenser and the following:
 - a. Removable sanitary-napkin waste receptacle with self-closing, disposal-opening cover.
 - b. Seat-cover dispenser with minimum capacity of 500 single or half-fold seat covers.
 - 3. Mounting: Partition mounted, dual access with two tissue rolls per compartment and with one side that mounts flush with partition of accessible compartment.
 - 4. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch-(114- or 127-mm-) diameter tissue rolls.
 - 5. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 7. Lockset: Tumbler type.
- E. Paper Towel (Folded) Dispenser:

102800 -2 TOILET BATH AND LAUNDRY ACCESSORIES 10/2021 Edition

- 1. Basis-of-Design Product: As indicated on the drawings.
- 2. Mounting: Surface mounted.
- 3. Minimum Capacity: 400 C-fold or 525 multifold towels.
- 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- 5. Lockset: Tumbler type.
- 6. Refill Indicators: Pierced slots at sides or front.
- F. Automatic Paper Towel (Roll) Dispenser:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Description: Automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered.
 - 3. Mounting: Surface mounted.
 - 4. Minimum Capacity: 8-inch- (203-mm-) wide, 800-foot- (244-m-) long roll.
 - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 6. Lockset: Tumbler type.
- G. Waste Receptacle:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Mounting: Open top, recessed, Semirecessed, or Surface mounted.
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 4. Liner: Reusable vinyl liner.
 - 5. Lockset: Tumbler type for waste-receptacle.
- H. Combination Towel (Folded) Dispenser/Waste Receptacle:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 - 3. Mounting: Surface mounted, Recessed, or Semirecessed.
 - a. Designed for nominal 6-inch (150-mm) wall depth.
 - 4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
 - 5. Minimum Waste-Receptacle Capacity: 4 gal. (15 L).
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 7. Liner: Reusable, vinyl waste-receptacle liner.
 - 8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
- I. Liquid-Soap Dispenser :
 - 1. Basis of Design Product: As indicated on the drawings.
 - 2. Description: Designed for dispensing soap in liquid, lotion, or lather form.
 - 3. Mounting: [Deck mounted on vanity] [Deck mounted on lavatory] [Horizontally oriented, surface mounted] [Vertically oriented, surface mounted].
 - 4. Capacity: 16 oz. (473 mL).
 - 5. Materials: Stainless steel, ASTM A480/A480M No. 4 finish (satin) for all exposed surfaces.
 - 6. Lockset: Tumbler type.
 - 7. Refill Indicator: Window type.
- J. Grab Bars:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4, satin finish.
 - 4. Outside Diameter: 1-1/2 inches (38 mm) OD.
 - 5. Configuration and Length: As indicated on Drawings.
- K. Sanitary-Napkin Disposal Unit :
 - 1. Basis-of-Design Product: As indicated on the drawings.

- 2. Mounting: Recessed, Partition mounted, dual access, or Surface mounted.
- 3. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
- 4. Receptacle: Removable.
- 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- L. Seat-Cover Dispenser:
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Mounting: Surface mounted, Recessed, or Partition mounted, dual access.
 - 3. Minimum Capacity: 250 seat covers.
 - 4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 5. Lockset: Tumbler type.
- M. Mirror Unit :
 - 1. Basis-of-Design Product: As indicated on the drawings.
 - 2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard, Welded and ground smooth.
 - 3. Size: As indicated on the drawings.
- N. Hook
 - 1. Basis-of-Design Product: As indicated on the drawing.
 - 2. Description: Double-prong unit.
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 HAND-SANITIZER DISPENSERS

- A. Source Limitations: Obtain hand-sanitizer dispensers from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product approved by Architect.
- C. Hand-Sanitizer Dispenser:
 - 1. Description: Manually operated dispenser with drip tray, designed for dispensing alcohol-based hand rub in [gel] [foam] form. Designed to not release contents unless manually activated and to not dispense more hand rub than the amount required for hand hygiene consistent with label instructions.
 - 2. Mounting: Wall mounted.
 - 3. Protrusion Limit: Installed unit protrudes maximum 4 inches (102 mm) from wall surface.
- D. Automatic Hand-Sanitizer Dispenser:
 - 1. Description: Automatic, battery powered operated dispenser with drip tray, designed for dispensing alcohol-based hand rub in [gel] [foam] form. Designed to not release contents unless manually activated and to not dispense more hand rub than the amount required for hand hygiene consistent with label instructions. Designed for activation to only occur when an object is placed within 4 inches (102 mm) of sensing device and so that an object placed and left within the activation zone will not cause more than one activation.
 - 2. Mounting: Wall mounted.
 - 3. Protrusion Limit: Installed unit protrudes maximum 4 inches (102 mm) from wall surface.

2.5 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch (0.8-mm)(22ga) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM 16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm)(20ga) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written recommendations.

END OF SECTION 102800

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.
 - 4. Solid surface material sinks.
 - B. Related Requirements:
 - 1. Section 224100 "Residential Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.2 SUBMITTALS

- A. Action, Informational, and Sample submittals: All action and informational submittals listed below are to be submitted in a single pdf at one time. Combining of more than one specification section in a single submittal is not permitted.
 - 1. Product Data:
 - a. For countertop materials and sinks.
 - b. Qualification Data: For fabricator.
 - 2. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - a. Show locations and details of joints.
 - b. Show direction of directional pattern, if any.
 - 3. Samples: For the following products:
 - a. Countertop material, 6 inches (150 mm) square.
 - b. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10inches (200 by 250mm), of construction and in configuration specified.
- B. Closeout Submittals
 - 1. Maintenance Data: For countertops to include in maintenance manuals.

1.3 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.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

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1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 - 1. Type: Provide Standard type unless Special Purpose type is indicated.
 - 2. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
 - 3. Colors and Patterns: As indicated on Drawings.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue, CARB NAF or CARB ULEF.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.

B. Configuration:

- 1. Front: Straight, slightly eased at top.
- 2. Backsplash: Straight, slightly eased at corner.
- 3. End Splash: Matching backsplash.

C. Countertops:

- 1. 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes and End Splashes: 1/2-inch- (12.7-mm-) thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes and end splashes for field assembly.
 - 2. Install integral sink bowls in countertops in the shop.
- F. Joints:
 - 1. Fabricate countertops in sections for joining in field, with joints at locations indicated.
 - a. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.
 - b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- G. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

- a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
- 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.
- 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, grommets, and similar items.

2.3 ACCESSORIES

- A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide "XG series" by Doug Mockett & Company, Inc.
 - 2. Outside Diameter: 3 inches (76 mm).
 - 3. Color: As selected by Architect from manufacturer's full range.
- B. Waste Trash Management Grommets through Countertops: Circular, molded-plastic grommets for trash management.
 - 1. Product: "TM Series" by Doug Mockett & Company, Inc.
 - a. Optional Lid for Trash Management Grommet; TM Lid by Doug Mockett & Company, Inc.
 - 2. Outside Diameter: 8 inches (203 mm).
 - 3. Colors: As selected by Architect from manufacturer's full range.

2.4 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface manufacturer.
 - All adhesives applied onsite shall be compliant with California Department of Health Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1 (2010) or Version 1.2 (2017) (also known as Specification 01350).
 - 2. All adhesives applied onsite shall meet the following VOC limits:
 - a. Contact adhesive: 80 g/L.
 - b. Multipurpose construction adhesive: 70 g/L.
 - c. Other adhesives: 250 g/L.
 - d. Follow more stringent local, regional, state and federal requirements where applicable.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material 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 (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. 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.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. 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.
- F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- G. 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.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Access doors.
 - 2. Insulation.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is part of each Division 21 Section.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.
- B. Make temporary connections required to maintain services during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before interrupting services.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at time of bid shall be used.
 - 1. ANSI American National Standards Institute.
 - 2. ASTM American Society for Testing and Materials.
 - 3. CCR California Code of Regulations.
 - a. Title 8 Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.
 - 4. NCPWB National Certified Pipe Welding Bureau.
 - 5. CEC California Electrical Code.
 - 6. NEMA National Electrical Manufacturers' Association.
 - 7. NFPA National Fire Protection Association, as amended by the CBC.
 - 8. OSHA Occupational Safety and Health Act.
 - 9. UL Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
 - 1. The publications listed below form part of this Specification. Comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2019.
 - b. California Electrical Code, 2019.
 - c. California Energy Code, 2019.
 - d. California Fire Code, 2019.
 - e. California Green Building Standards Code, 2019.
 - f. California Mechanical Code, 2019.
 - g. California Plumbing Code, 2019.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.

- k. California State Fire Marshal, Title 19 CCR.
- I. DSA Division of the State Architect. Interpretive Regulations (IR's).
- m. National Fire Protection Association, as amended by the CBC.
- n. Occupational Safety and Health Administration.
- o. Other applicable state laws.
- 2. Nothing in Drawings or Specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 2. Because of the small scale of fire protection Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
 - 3. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
 - 4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

- A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with the requirements of Division 1.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
 - Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General:
 - a. Coordinate Work in this Section with trades covered in other Specification Sections to provide a complete and operable installation of highest quality workmanship.
 - 2. Electrical Coordination:

- a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified in this Section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of bid.
 - Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
- 3. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.8 SUBMITTALS

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
 - 1. Partial or incomplete submittals will not be reviewed.
 - 2. Quantities are Contractor's responsibility and will not be reviewed.
 - 3. Provide materials of same brand or manufacturer for each class of equipment or material.
 - 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 - 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 - 6. Organize submittals in same sequence as in Specification Sections.
 - 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit shop drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

- D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
 - Shop drawings and submittals shall include Specification Section, Paragraph number, and Contract Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from Contract Documents shall be clearly identified and appear at the beginning of submittal package, and shall be referenced to applicable Contract Documents requirements.
- E. Provide layouts for fire protection systems, for inclusion in coordinated layout specified in Section 238000. Comply with requirements for layouts specified in Section 238000.

1.9 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for fire protection systems materials and products.
- B. Shop Drawings.
- C. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.
- D. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.
- E. Delegated-Design Submittal: For seismic supports, anchorages, and restraints indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, and seismic restraints shall utilize criteria indicated in Structural Contract Documents.
 - 2. Supports, anchorage and restraints for piping and equipment shall be an OSHPD pre-approved system such as Tolco, ISAT, Mason, or equal. Pipes and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code and NFPA 13. System shall have current OPA number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
 - 3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, equipment, and restraint locations, and detailing supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with California Building Code and NFPA 13.
 - 4. Additional Requirements: In addition to the above, conform to State and local requirements.

1.10 INFORMATIONAL SUBMITTALS

- A. Provide coordination drawings for fire protection systems in accordance with the requirements of Specification Section 211000.
- B. Furnish to Project Inspector complete installation instructions on material and equipment before starting installation.

1.11 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Refer to Division 01 for complete instructions.
 - 2. Furnish three complete sets of Operating and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operating and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - Record Drawings.
 - Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating instructions for each item of fire sprinkler system.
 - a) Original manual of NFPA-25 for fire sprinkler system.
 - 6) Copies of guarantees/warrantees for each item of equipment or systems.
 - 7) Test data as specified.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) A complete list or schedule of scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
 - 11) Check test and start reports for each piece of fire protection equipment provided as part of the Work.
 - 12) Commissioning and Preliminary Operation Tests required as part of the Work.
 - b. Post service telephone numbers and addresses in an appropriate place designated by Architect.
- B. Record Drawings:
 - 1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
 - 2. Upon completion of the work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Project Inspector for all record drawings.

1.12 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.
- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.

- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material will not waive these requirements.
- G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.13 DELIVERY, STORAGE AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.
- B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by Architect and shall be made without additional cost to Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within warranty period, including damage caused by leaks.
- C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum.
- C. Refer to Section 211000 for specific system piping materials.

2.2 MATERIALS

- A. No material installed as part of this Work shall contain asbestos.
- B. California Green Building Code Compliance:
 - 1. Fire protection equipment shall not contain CFCs.
 - 2. Fire protection equipment shall not contain Halons.

2.3 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to fire protection equipment or devices, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. Access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08, except as noted in this Section.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for other areas.
- D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with Architect when access is required in these areas.
- E. Where specific information or details relating to access panels different from the above is shown or given on Drawings or other Divisions of work, that information shall supersede this specification.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor:
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (masonry).
 - d. Style "Fire Rated" where required.

2.4 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.
- B. Text of Signs: Provide identification of equipment unit number, and room or area served. Coordinate name of area served with final room names and numbers for the facility. In addition, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2.5 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legends and flow arrows shall conform to ASME A13.1.

2.6 INSULATION WORK

- A. General:
 - 1. Adhesives shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 - 2. The term "piping" used herein includes pipe, valves and fittings.
 - a. Apply insulating cement to fittings, valves and strainers and trowel smooth to equal the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to bonnet. Leave strainer cleanout plugs accessible.
 - b. Provide pre-formed PVC valve and fitting covers.
 - c. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
 - Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.
 - 4. Clean thoroughly, test and have approved, piping and equipment before installing insulation and/or covering.
 - 5. Repair damage to existing pipe insulation whether or not caused during Work of the Contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be reinstalled, and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.
- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.
- D. Existing piping and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 FRAMING, CUTTING AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 DEMOLITION

- A. Refer to Division 01 Sections "Cutting and Patching" and/or "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, dismantle and remove fire protection systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material.
 - 3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the fire protection Work with the electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for controls. Before permitting operation of equipment which is furnished, installed, or modified under this Section, Contractor shall review associated electrical work, including overload protection devices, and assume complete responsibility for correctness of electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. Equipment and connections exposed to weather shall be installed in NEMA IIIR enclosures with factory wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with fire protection system are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and Painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

- a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
- 2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the highest grade zinc rich primer. After erection or installation, primed surfaces shall be properly cleaned of foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Abrasion or other damage to shop or field prime coat shall be properly repaired and touched up with same material used for original priming.
- 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 PIPING SYSTEMS INSTALLATION

- A. At time of final connection, and prior to opening valve to allow pressurization of water piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on fire protection piping is greater than 175 psi, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.
- B. General:
 - 1. Piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
 - 2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
 - 3. Install piping to permit application of insulation where required and to allow valve servicing.
 - 4. Where piping or conduit is left exposed within a room, the piping or conduit shall be run true to vertical, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
 - 5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from Architect.
 - 6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
 - 7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
 - 8. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
 - 9. Install horizontal valves with valve stem above horizontal.
 - 10. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
 - 11. Verify final equipment locations for roughing-in.
 - 12. Where piping is installed in walls within one inch of face of stud, provide 16 gauge sheet metal shield plate on face of stud. The shield plate shall extend minimum 1-1/2 inches beyond outside diameter of pipe.

C. Sleeves:

- Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations, as directed, shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
- At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate pipe from concrete.
- D. Floor, Wall, and Ceiling Plates:

1. Fit pipes, with or without insulation, passing through walls, floors, or ceilings, and hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

E. Firestopping:

- 1. Pack annular space between pipe sleeves and pipe through floors and walls with UL listed fire stop, and seal at ends. Pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind fire protection services installed within fire rated walls, to maintain continuous rating of wall construction.
- 2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators, or equal, for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and with Chapter 7, CBC requirements.
- 3. Sleeve penetrators shall have built in anchor ring for waterproofing and anchoring into concrete pours or use special fit cored hole penetrator for cored holes.
- 4. Copper and steel piping shall have SpecSeal plugs, or equal on both sides of penetrator to reduce noise and to provide waterproofing.
- 5. All above systems to be installed in strict accordance with manufacturer's instructions.
- 6. Alternate firestopping systems are acceptable if approved as equal. Contractor is responsible for determining suitability of alternate products for their intended use, and shall assume all risks and liabilities in connection with the use of alternate products.
- F. Hangers and Supports:
 - 1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers as required. Hangers and supports shall be UL listed for fire protection service. Components shall support weight of equipment, pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, shall be of same size as pipe or tubing on which used, or nearest size available. Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide "trapeze" (bridging) support members attached to building structural members by methods approved by structural Engineer.
 - a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - 2. Hanger components shall be provided by one manufacturer. B-Line, Grinnell, Tolco, Afcon, Loos & Co., Uni-Strut, or equal.
 - 3. Hanger and Supports:
 - a. Vertical Piping: Tolco Fig. 6, or equal, clamps attached to pipe above each floor to rest on floor. Provide intermediate support for vertical piping greater than 25 feet in length.
 - b. Individually Suspended Piping: Tolco Fig. 200 or Fig. 1 Clevis, complete with threaded rod, or equal.

Pipe Size	Rod Size
4" and Smaller	3/8"
5" to 6"	5/8"

- c. Trapeze Suspension: Sch-10 or Sch-40 steel pipe trapeze member in accordance with NFPA 13published load ratings.
- d. Pipe Clamps and Straps: B-Line B2000 or B2400, Tolco, Fig. 200 or Fig. 1, or equal. Where used for seismic support systems, provide B-line B2400, Tolco fig. 69 series retainer pipe straps, or equal.
- e. Concrete Inserts: B-line B221 continuous insert or B2500 spot insert, or equal. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
- f. Steel Connectors: Tolco Fig. 65 beam clamps with Fig. 69 retainer straps, or equal.

- g. Deck Connectors: Afcon Fig. 610 steel ceiling plate, or equal, where approved by structural Engineer.
- 4. Support to Structure:
 - a. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of structural components. Burning or welding on structural member may only be done if approved by Architect.
- 5. Pipe hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced per NFPA 13, and per pipe manufacturer's listing, except as noted below.
- 6. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
- 7. Insulate copper piping from ferrous materials and hangers with two layers of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
- 8. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
- 9. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.8 UNIONS AND FLANGE INSTALLATION

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel pipe or material. Bushings or couplings shall not be used.
- B. Install unions in piping NPS 2" and smaller and flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to equipment and tanks, and at connections to automatic valves.
- C. Locate unions for easy removal of equipment, tanks, or valves.

3.9 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of fire protection systems. Access doors shall provide for complete removal and replacement of equipment.

3.10 CONCRETE WORK

- A. Concrete work required for Work of this Section shall be included under another section of the Specification, unless otherwise noted, including reinforced concrete bases for pumps, tanks, compressors unless the work is specifically indicated on Drawings to be furnished under this Section.
- B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specifications. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.11 PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the Work.
- B. Apply legend and flow arrow at valve locations; at points where piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with approval of Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
- C. Wherever two or more pipes run parallel, markings shall be supplied in the same relative location on each.

- D. Apply markings after painting and cleaning of piping and insulation is completed.
- 3.12 EXPANSION ANCHORS IN HARDENED CONCRETE:
 - A. Refer to Structural Drawings.

3.13 TESTS AND ADJUSTMENTS

- A. Test installations in accordance with the following requirements and all applicable codes:
 - 1. Project Inspector should witness tests of piping systems.
 - 2. Notify Architect at least seven days in advance of tests.
 - 3. Notify local fire department of time and date of fire systems testing.
 - 4. Piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
 - 5. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 - 6. Isolate from system equipment that may be damaged by test pressure.
 - Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems only. Remove plate and complete connection to existing system at completion of testing.
 - a. Project Inspector shall witness final connection to system.
- B. Test Schedule: No loss in pressure or visible leaks shall show after four hours at pressures indicated:

System Tested	Test Pressure PSI	<u>Test With</u>
Fire Sprinkler Piping	200	Water

- 1. Piping, including underground piping, connected to fire sprinkler system shall be tested and certified in accordance with NFPA requirements, except where requirements listed in this Section exceed requirements of NFPA.
- 2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with type of gas conveyed by piping system.
- C. Should material or work fail in any of these tests, it shall be immediately removed and replaced with new material, and portion of work replaced shall again be tested by Contractor at his own expense.
- D. Lubricate each item of equipment, including motors, before operation.

3.14 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of fire protection equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 - Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 - 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.15 COMMISSIONING AND PRELIMINARY OPERATIONAL TESTS

- A. Prior to observation to determine final acceptance, put fire protection systems into service and check that work required has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of tests.
 - 1. Equipment has been started, checked, lubricated and adjusted in accordance with manufacturer's recommendations.
 - 2. Correct rotation of motors and ratings of overload heaters are verified.
 - 3. All manufacturers' certificates of start-up specified have been delivered to Owner.
 - 4. All equipment has been cleaned, and damaged painted finishes touched up.
 - 5. Missing or damaged parts have been replaced.
 - 6. Flushing of piping systems has been completed and water treatment equipment, where specified, is completed.
 - 7. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 - 8. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 - 9. Maintenance manuals have been delivered and Owner training has been completed.
- B. Review of Contractor's Tests:
 - 1. Tests made by Contractor or manufacturers' representatives are subject to observation and review by Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon completion of tests, provide letter to confirm that testing has been successful.
- C. Test Logs:
 - 1. Maintain test logs listing the tests on mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of tests.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Sprinkler heads.
 - 2. Pipe and Fittings.
 - 3. Valves.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 210050 Basic Fire Sprinkler Materials and Methods.

1.3 REFERENCES

- A. It is the intent of these Specifications to provide for complete and operating fire protection automatic sprinkler system in full compliance with the following standards:
 - 1. National Fire Protection Association (NFPA) Standard No. 13, 2016, as amended by the CBC.
 - 2. CBC Chapter 9.
 - 3. NFPA No. 24, 2016 (as amended).
 - 4. NFPA No. 25, 2013 (California Edition).
- B. The work shall also be in accordance with all local or state requirements that apply.

1.4 DESCRIPTION OF WORK

- A. Work of this section includes, but is not limited to, the following:
- B. An existing fire sprinkler system is in place, consisting of a fire sprinkler riser for each zone with the main supply line and zone control valve for each floor, branch lines, and tees to each sprinkler head. Extend and modify the existing system as required to properly protect the building in accordance with NFPA 13 criteria.
- C. Furnish all coordination, labor, design drawings, calculations, materials, tools, and equipment to install the wet pipe automatic fire sprinkler system as described in this Specification Section. System shall be hydraulically calculated and designed for the building occupancy classification as determined by NFPA 13.
 - 1. The Work includes, but is not limited to the following:
 - a. Complete interior wet type automatic fire protection spray type sprinkler distribution system, including overhead service and branch mains, lateral supply piping, supports, hangers, seismic bracing, and heads
 - b. Required tests and inspections.
 - c. Provide electrical work required to complete the system. Contractor shall be responsible for providing complete and operable systems, including electrical wiring. Install wiring in conduit, in accordance with Division 26.
 - d. Protected areas shall include areas above and below the finished ceilings, exterior exposure, canopies, stairways, rooms, areaways, entry, etc, and other areas requiring sprinklers. Thoroughly examine architectural and other drawings as required to satisfy this requirement.
 - e. Tags, identification labels and instruction manuals for proper operation and maintenance.

- D. Provide fire sprinklers to protect combustible building overhangs greater than 4 feet wide, as required by local authority.
- E. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.
 - 1. Test data for static and residual pressure shall be obtained from water district or local fire department; test shall be made within the last six months prior to start of work.
 - 2. Provide calculations based on 10 percent minimum safety factor. For hydraulically calculated fire sprinkler systems the maximum velocity in the building and the fire main piping shall not exceed 15 feet per second.

1.5 DRAWINGS

- A. Contractor shall thoroughly examine architectural, structural, and other Drawings provided as part of this Contract.
- B. Number of sprinkler heads indicated on Contract Drawings shall not be reduced. Provide additional heads required for coordination and to obtain approvals. Coordinate suitable head locations and spacing with Architect.

1.6 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: A firm with at least five years of successful installation experience on projects with fire sprinkler piping systems similar to that required for this Project.
 - 1. A State of California Fire Protection Contractor's license (C-16) is required.
- C. Fire Sprinkler Fitter Certification:
 - 1. Automatic fire extinguishing systems sprinkler pipefitters shall be certified by Office of the State Fire Marshall (OSFM).
- D. Design Criteria: Provide complete fire protection systems as indicated and as required by authority having jurisdiction.
 - 1. When there is conflict between requirements of authority having jurisdiction or requirements of other agencies and these Drawings and Specifications, requirements of authority having jurisdiction and recommendations of standards agencies shall govern.
 - 2. Design and install entire system in accord with applicable codes, standards, and regulations.
 - The automatic sprinkler system shall conform to requirements of the National Fire Protection Association, Standard No. 13, as amended by the CBC. Contractor shall hydraulically calculate sprinkler system in accordance with NFPA 13.
 - 4. Drawings are diagrammatic only to indicate rooms/areas of sprinkler protection and piping clearances when appropriate. Rerouting of pipe and addition, deletion or relocation of heads may be necessary. Submit proposed layout for approval prior to start of installation.
 - 5. FM Compliance: Comply with Factory Mutual "Approval Guide."
 - 6. Supply equipment and accessories in accordance with requirements of all applicable national, state and local codes.
 - 7. Items of a given type shall be the products of the same manufacturer.
 - 8. Scheduled equipment performance is minimum capacity required.
 - 9. Scheduled electrical capacity shall be considered as maximum available.

1.7 COORDINATION

A. Coordinate Work in this Section with trades covered in other Sections of Specifications to provide a complete and operable installation of highest quality workmanship.

- B. Coordinate location of fire protection piping, mains and branches, to avoid interference with work by other trades. Plumbing drainage piping and ductwork shall have right-of-way over fire protection piping. Wherever conflicts exist, fire protection piping shall be offset or rerouted at no additional cost to Owner. Provide locations of piping for use in Coordinated Layout called for in Specification Section 238000.
- C. Piping shall be concealed, except where so indicated or where absolutely necessary to be exposed. Exposed piping shall be placed as approved by Architect prior to installation. Heads shall be fully coordinated with architectural reflected ceiling plan and placed in center of ceiling tiles.
- D. On-site measurement of pipe will be required. Offsets, pipe, fittings, drains, etc., required to meet job conditions shall be furnished and installed at no extra cost to Owner.
- E. Additional heads required by NFPA 13 regulations shall be provided at no extra cost, if required as a result of Contractors' coordination. Location of heads and mains shall not be changed unless approved by Architect.
- F. Coordinate layout and installation of sprinklers with other construction penetrating ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- G. The Architect shall decide any differences or disputes concerning coordination, interference or extent of work, and his decision shall be final.

1.8 SUBMITTALS

- A. Samples: Provide one sample of each sprinkler head type.
- B. Shop Drawings: Submit in accordance with Division 01, and as follows:
 - Prepare Drawings, calculations, and product data of fire protection systems indicating pipe sized, pipe locations, fittings, shutoffs, equipment, etc. Note, in bold type, any piping which will project beyond finished surfaces of normally occupied rooms, exterior of the building or other locations which will expose the system to view.
 - 2. Layout drawings and flow calculations approved by agencies having jurisdiction.
 - 3. Drawings and calculations shall be stamped and signed by a State of California licensed professional engineer prior to submission to the Architect. Engineer shall be qualified for this work.
- C. Manufacturer's data for each item of material or equipment used.
- D. Welding operator qualification certificates.
- E. Office of the State Fire Marshall (OSFM) certification cards for automatic fire extinguishing systems sprinkler pipefitters.
- F. Test Reports: As indicated in paragraph "Tests".
 - 1. Sprinkler pressure test.
 - 2. Alarm system test.
 - 3. Underground piping test.
- G. Operation and Maintenance Manual:
 - 1. Operation and Maintenance Manual in accordance with Section 210050. Include an original copy of NFPA 25, California edition, in Operation and Maintenance Manual for fire sprinkler system.
 - 2. Guarantees in accordance with Division 01.
- H. Deferred Approval Documents: Do not proceed with fabrication or installation of fire sprinkler system until deferred approval documents have been approved by regulatory agencies.
 - 1. General: Provide detailed drawings, specifications, and calculations prepared by a State of California licensed professional engineer.

- a. Documents produced by the Contractor shall be stamped and signed by the licensed mechanical engineer responsible for their preparation.
- 2. Architect Review: Make additions, changes and corrections as directed by Architect and resubmit.
- 3. Agency Review: Architect will submit documents to Agency or Authority Having Jurisdiction. Make additions, changes and corrections required by Agency / Authority at no cost to Owner and resubmit to Architect.
- 4. Agency Approval: Architect will submit documents to Agency / Authority for final approval.

1.9 APPLICABLE PUBLICATIONS

- A. The following publications form a part of this specification:
 - 1. ANSI American National Standards Institute.
 - 2. ASME American Society of Mechanical Engineers.
 - 3. UL Underwriters' Laboratories, Inc. Fire Resistance Directory.
 - 4. CBC California Building Code.
 - 5. NFPA National Fire Protection Standards as amended by the CBC.
 - 6. CFC California Fire Code.
 - 7. CPC California Plumbing Code.

1.10 SUPERVISION

A. Keep a competent superintendent on the job that shall coordinate the activities of the crafts and maintain the progress of the work to the satisfaction of the Architect.

1.11 SITE CONDITIONS

A. Verify all dimensions at the building site and check existing conditions before beginning work. Make changes that are necessary to coordinate the work with other trades, after review by the Architect.

1.12 REGULATIONS

A. All work shall be installed in strict conformity with California Building Code (CBC), California Plumbing Code (CPC), and California Electric Codes (CEC), Industrial Safety Orders, California Mechanical Code (CMC), California Fire Code (CFC), and other laws and regulations of authorities having jurisdiction.

1.13 FEES AND PERMITS

A. Take out permits and pay fees and charges required in connection with the Work.

1.14 TEMPORARY CONNECTIONS

A. Temporary connections required to maintain services during the course of the Contract shall be made without additional cost to Owner. The normal function of the building must not be interrupted; notify Owner minimum seven days in advance before interrupting any service.

1.15 EXISTING MATERIALS

- A. Existing equipment, piping, construction, etc., which interferes with work of the Contract shall be removed and promptly returned to service. Damaged items shall be replaced with new material to match existing.
- B. Removed materials which will not be reused and which are not claimed by the Owner shall become the property of the Contractor and shall be removed from the premises. Consult Owner before removing any material from premises. Materials claimed by Owner shall be removed carefully to prevent damage and delivered on the site where directed.

C. Existing piping not to be reused and which is concealed in the building construction may be capped and abandoned in place but such piping and wiring which is exposed in equipment rooms or occupied spaces shall become property of Contractor and shall be removed from the premises.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment to be furnished under this Specification shall be standard product of manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, component parts of system need not be products of the same manufacturer.

2.2 MATERIALS AND EQUIPMENT

A. Unless otherwise shown on Drawings, specified, or directed by Architect, materials and equipment used in installation of sprinkler systems shall be listed as approved by FM or UL for fire protection systems, and shall be the latest design of the manufacturer.

2.3 SPRINKLER HEADS

- A. Provide spray pattern type sprinkler heads, of ordinary degree temperature rating, except that sprinkler heads for installation in vicinity of heating equipment, and in other areas noted on Drawings, shall have temperature ratings required for such locations by NFPA 13.
- B. Sprinkler heads shall be upright, pendent, or sidewall, as required.
 - 1. Heads in ceilings of occupied spaces with recessed lights shall be chrome plated, semi-recessed pendent type, with white escutcheon.
 - 2. Sprinkler heads in rooms with surface mounted lights shall be chrome plated pendant style, with twopiece white escutcheon.
 - 3. Provide head guards in equipment rooms and storage rooms and all other locations where subject to damage.
 - 4. Upright heads in areas with no ceilings shall be rough bronze finish.
 - 5. Provide quick response type heads in light and ordinary hazard occupancies.
 - 6. Side wall heads may be used (except in extended coverage type) to cover special areas where overhead piping and heads are impractical or a considered visual problem by the Architect or Owner. Side wall heads shall be chrome finish.
 - 7. Outdoor heads, if required shall be dry or freeze resistant.
 - 8. Adjustable drop nipples are not acceptable.
- C. Recessed sprinkler heads shall have chrome finish and adjustable chrome finish escutcheons; exposed pendent heads in finished ceilings shall have chrome finish and white ceiling escutcheons. Concealed (flush) heads shall be all brass, with white cover plate.
 - 1. Provide oversized escutcheons where required to meet the requirements of ASCE 7.
- D. Spare Heads: Furnish spare heads equal to one percent of total number of heads installed under Contract, but not less than twelve. Spare head types furnished shall be representative of types and temperature ratings of heads installed, and in proportion to number of each type and temperature rating of heads installed. Furnish not less than two sprinkler head wrenches, with at least one wrench for each type of sprinkler head installed. Place spare heads and wrenches in wall mounted box manufactured for this purpose.

2.4 PIPE AND FITTINGS

A. For Installation Aboveground: 150 PSI, Schedule 40 black steel pipe, ASTM A-53 with ductile or cast iron screwed fittings.

- 1. Schedule 10 black steel pipe, ASTM A 135 or ASTM A 795, with grooved fittings and associated couplings may be used for pipe sizes 2 inches through 5 inches. Provide NFPA 13-specified wall thickness for pipe sizes 6 inches through 10 inches. Threading of piping will not be accepted.
- B. Mechanical tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

2.5 VALVES

- A. Angle, Check, and Globe Valves: Fed. Spec WW-V-51; Class A, type as suitable for application.
 - 1. Select check valves for installation in vertical lines recommended by manufacturer as suitable for vertical installation. Install in vertical lines only where flow is upward.
- B. Gate Valves:
 - 1. Sizes 1-1/2 inches or less: Fed. Spec WW-V-54, Class A.
 - 2. Sizes above 1-1/2 inches: Fed. Spec WW-V-58, Class A, designation OS or OF, as required. Provide OS&Y type, 175 pound rated working pressure.
 - 3. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- C. Drain Valves: angle, or globe. Fed. Spec WW-V-51; Class A, type as suitable for application.
 - 1. UL listed and FM approved combination test and drain fittings may be used.
- D. Zone Control Valves: UL listed, outside screw and yoke or butterfly. Valves shall be sealed open with approved seal. Provide weatherproof actuator housing, with two single pole, double throw switches.
 - 1. Supervisory Switch: Fit the control valves on the fire sprinkler risers with supervisory switch, with single pole double throw switch actuator installed to change switch position when valve is being closed.
- E. Sprinkler Inspector's Test Fittings:
 - 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Body Material: Cast- or ductile-iron housing with sight glass.
 - 4. Integral factory or field-installed pressure relief valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.

2.6 UNION AND FLANGES

- A. Size and Type:
 - 1. Steel 2 inches and smaller: 150 pound screwed black or galvanized malleable iron, match pipe, ground joint, brass to iron seat.
 - 2. Steel 2-1/ inches and larger: 150 pound black flange union, flat faced, full gasket.
- B. Gaskets: 1/16 inch thick rubber Garlock #122, Johns-Manville, or equal.
- C. Flange Bolts: Open hearth bolt steel, square heads, with cold pressed hexagonal nuts, cadmium plated when installed below ground. Provide copper plated steel bolts and nuts or brass bolts and nuts for brass flanges.

2.7 GAUGES

A. Marsh "Quality Gage", U.S. Gage, Danton 800, or equal, U.L. listed, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at midscale. Provide a three-way valve on each gauge connection.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been approved by the State Fire Marshal.
 - 1. Piping shall be concealed unless shown or otherwise directed.
 - 2. Where piping is left exposed within a room, it shall be run true to vertical, horizontal or intended planes. Where possible, uniform margins shall be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.
 - 3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. This clearance shall not be less than 6'-6" without written approval from Architect.
 - 4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by Architect at no additional cost to Owner, providing such change is ordered before such items of work, or work directly connected to same, are installed and providing no additional material is required.
 - 5. Grade all piping as required by NFPA 13.
 - 6. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation.
 - 7. Piping systems shall be thoroughly flushed and proved clean before connection to equipment.
 - 8. Pipe discharge of each drain valve to floor sink or drain.

3.2 HANGER AND SUPPORT INSTALLATION

- A. General: Support piping so that it is firmly held in place by approved iron hangers and supports and by special hangers as required in accordance with NFPA 13. Hangers shall support loads specified in NFPA 13, and, in addition, shall support weight of pipe, fluid and pipe insulation, based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments, or hangers, shall be of same size as pipe or tubing on which used, or nearest larger size available. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS) Standard Practice SP-58, provide branch line restraints where hangers exceed 6 inches long, in accordance with NFPA 13. Install concrete anchors required. Hanger material shall be approved by Architect before installation. Do not support piping by plumbers' tape, wire, rope, wood or other makeshift devices.
- B. Suspend rods from angle clips, in accordance with Section 210050.

3.3 SEISMIC REQUIREMENTS

- A. Comply with CBC, Volume 2, Chapter 16A and CBC Chapter 9 and NFPA 13.
- B. Seismic bracing system shall be a complete pre-engineered bracing system. Pre-engineered bracing system shall include plan layout, brace selection, specification, and calculations. Complete system shall be submitted to Architect for review. See Delegated Design Submittal paragraph in article, Submittals, in Section 210050.
- C. Anchorage for various manufactured and fabricated items is detailed and scheduled on the drawings or specified.
 - 1. For proposed changes to anchorage shown, or specified, submit proposed methods of anchorage with calculations prepared by a California Registered Structural Engineer. Design of anchorage shall comply with the above regulations using minimum coefficients, CP, listed CBC Chapter 16A.
- D. It is not intended that prototype or non-standard equipment or equipment frames be provided. However, items of equipment shown or specified to be anchored shall maintain integrity at point of anchor after being subjected to accelerations equivalent to those established herein.

E. Anchors: Piping shall be provided with anchors for protection of piping against damage due to earthquakes, as required by CBC Chapter 16A, NFPA 13, and other sections of this Specification.

3.4 TESTS

- A. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.
- B. Upon completion and prior to acceptance of the installation, subject entire new system to tests required in NFPA 13, and furnish Owner with certificates as appropriate.

3.5 IDENTIFICATION

- A. Coordinate requirements with the authority having jurisdiction.
- B. Provide brass valve tags at each system valve, indicating valve service.
- C. Provide signage at each sprinkler valve, with sign indicating specific portion of system controlled by valve.
- D. Provide signage at each outdoor alarm device, with sign indicating which authority to call if device is activated.
- E. Prior to final acceptance, Contractor shall provide accurate color-coded Building Plan at riser location, clearly depicting fire protection system area of coverage, location of inspectors' test/drain connection and auxiliary drain connections. Provide this information at each system or building at riser location for building. Plan(s) shall be one-half size and plastic laminated.
- F. Provide hydraulic data signage permanently attached to risers, indicating location, basis of design, water supply and pressure requirements of system.

3.6 ELECTRICAL WIRING

- A. Coordination of wiring systems is part of this work. Contractor shall ensure that the following is completed.
 - 1. Work provided in other Specification Sections:
 - a. Supervised wiring to fire alarm control panel.
 - b. Supervised wiring from main waterflow indicator to fire alarm panel.
 - c. Supervised wiring from sprinkler flow switches to fire alarm panel.
 - d. Supervised wiring from valve water flow alarm switches to fire alarm panel.
 - 2. Work provided in this Specification Section:
 - a. Wiring diagrams for devices.
 - b. Other wiring not specified to provide an operating system.

3.7 SPRINKLER HEAD INSTALLATION

- A. Heads shall be placed upright where on exposed piping, unless otherwise noted, and in pendant position on concealed piping, unless noted otherwise, with deflectors parallel to the ceiling or roof slope. Clearance between deflectors and ceilings, electric, or heating equipment, or other obstruction shall be in accordance with the requirements of NFPA 13. Provide sprinkler head guards where heads are subject to mechanical damage, for example, at mechanical rooms, and storage rooms and gymnasiums.
- B. Mount box containing spare sprinkler heads and wrenches on wall in location selected by Owner.
- C. Do not install pendent sprinkler heads until flushing of piping has been completed.
- D. Provide return bend as illustrated in NFPA 13 (NFPA exceptions do not apply) for each sprinkler head installed in finished ceiling.
3.8 PIPING INSTALLATION

- A. Pipe shall be assembled in accordance with the applicable requirements of NFPA 13 and NFPA 24.
- B. Provide concrete thrust blocks for underground and underslab piping in accordance with NFPA 24 and CBC.

3.9 VALVE IDENTIFICATION

A. All valves shall be identified by permanent metal tags or other approved means.

3.10 DRAIN INSTALLATION

- A. Auxiliary drains shall be installed on low points in each system.
 - 1. Five or fewer trapped gallons will not require a drain valve but may be drained through a plugged fitting. Drain valves shall be in accordance with the requirements of NFPA 13.
- B. Install one inspector's test drain on sprinkler system. Extend drain to outside in location approved by Architect. Water discharge shall be positioned such that landscaping will not be damaged.
- C. Drain valves shall be piped to a safe place of discharge and discharge shall be visible either by open-end drainpipe or sight drain fitting.
- D. Provide flushing connections at ends of cross-mains.

3.11 SLEEVE INSTALLATION

- A. Install AMI Products, Adjus-to-Crete, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
- B. Holes through existing concrete walls or floors shall be core drilled. The space between pipe and hole through floor slabs on ground, through outside walls above or below grade, through roof and other locations as directed shall be made watertight.
- C. At walls below grade Link-Seal casing seals, or equal, may be used in lieu of caulking. Pipes penetrating walls below grade shall be anchored at wall.

3.12 FLOOR, WALL, AND CEILING PLATE INSTALLATION

A. Fit pipes with or without insulation passing through walls, floors, or ceilings and hanger rods penetrating finished ceilings with chrome plated or stainless steel plates.

3.13 FIRESTOPPING

- A. The annular space between pipe sleeves and pipe passing through all floors and walls shall be packed with incombustible mastic or other suitable material, in accordance with U.L. Fire Resistance Directory.
- B. Penetrations in fire rated assemblies shall also be protected in accordance with CBC Chapter 7, Section 712, and UL Fire Resistance Directory.

3.14 UNION AND FLANGE INSTALLATION

- A. Install unions whether shown or not at each connection to equipment and at one connection to each valve or cock.
- B. Locate the unions for easy removal of the equipment or valve.

3.15 CLEANING

- A. Upon completion of tests, clean equipment, piping, etc., installed under this Section of the Specifications.
- 3.16 PIPING SYSTEM FLUSHING
 - A. Entire system shall be flushed out and cleaned after completion of piping, and prior to installation of sprinkler heads. Flush shall be continued until water runs clear at drain connections.

END OF SECTION

1.1 DESIGN CRITERIA

A. See Part II for additional information regarding Energy and Water Efficiency, etc.

1.2 SYSTEMS DEFINITION

A. Campus is served by three water distribution systems; potable, non-potable and agricultural water. The potable water is identified as the Campus Domestic Water Distribution System. This system serves the building domestic water, building industrial water and Campus fire water.

B. AGRICULTURAL WATER

1. The Agricultural Water Distribution system is designated as AG Water. This system is non- potable and has a dedicated piping distribution system serving the West Campus agricultural fields.

C. UTILITY WATER

1. The non-potable water supply system is designated as the Utility Water Distribution System and is primarily use for landscape irrigation. This system has a dedicated piping distribution system serving the main Campus only.

D. BUILDING DOMESTIC WATER

- 1. This system is used to provide for consumption and sanitary needs, industrial water needs, make- up water for mechanical system, and process water needs (i.e. DI, RO, etc.).
- 2. The building domestic water service shall provide the following:
 - a. Refer to Division 33 for requirements for reduced pressure backflow prevention devices (RPBP) and strainers.
 - b. After the backflow device, a water conditioning device using a modulating frequency wave form shall be installed. Scale Blaster, or equal, no known equal. Depending on the size of the system, it is possible more than one device may be needed, particularly at hot water heat exchangers where scale tends to build up. The conditioning system type shall be discussed with the University's Representative early in the design process before implementing a technology.
 - c. Perform water pressure calculations to determine the need for a domestic water booster pump. If needed, water booster pumps shall be controlled with VFDs and have pressure transducers.
 - d. Incoming domestic water shall be plumbed with injector fittings for water system chlorination testing.

E. FIRE WATER

1. This system utilizes domestic water for fire protection systems, including fire hydrants and sprinkler systems.

F. BUILDING INDUSTRIAL WATER

 A building's industrial water system is a branch of domestic water system and serves mainly laboratory spaces and fixtures. Industrial water is generated by installing reduced pressure backflow prevention (RPBP) devices at a tee, downstream of the building domestic water RPBP. This industrial water RPBP device is intended to protect the building occupants from labs and other research areas or mechanical spaces. Note, additional water conditioning as described above may be required after the RPBP. See section 22 67 00 Processed Water for Laboratory Facilities.

G. CARBON FILTERED WATER

1. Carbon filters are filled with activated carbon, and can be regenerated by a backwash cycle. Carbon filters shall be equipped with an electro mechanical metered Fleck valve, or equal. Carbon filters remove inorganic material (manmade) elements such as pesticides and chlorine. It is important to remove these elements upstream of the reverse osmosis system (RO), because these elements quickly destroy the RO membrane.

H. SOFTENED WATER

 Soft water is water that is treated by ion exchange within the softener. Elements such as iron, calcium, and magnesium are removed by ion exchange and replaced with sodium ions. This results in a slightly higher TDS. (From 360 TDS – 380 TDS) Water softeners shall be equipped with an electro–mechanical metered Fleck valve, or equal. (See Applied Membranes softeners)

I. REVERSE OSMOSIS (RO) WATER

 Reverse osmosis is a filtration method that removes particles by passing water across a semipermeable membrane. During the RO process, 95 – 99 percent of all dissolved solids and bacteria are removed. Most RO systems on campus are set at a 50 percent recovery rate, but can somewhat be adjusted to waste less water at the risk of reducing the life of the RO membrane. The water produced has 1-3ppm and is approximately ½ megohm in quality.

J. DEIONIZED (DI) WATER

1. Deionized water results from a filtration method which removes the electrically charged atoms and molecules by passing water through ion exchange resins. The Campus uses mixed bed resin beads in the ion exchange DI bottles, which exchanges elements such as potassium, aluminum, manganese, etc., for hydrogen and hydroxide ions to form pure H2O. In non-circulating systems, 2-10 megohm water is produced. In circulating loop systems with ultra-violet and high purity filters, purity can be as high as 18.3 megohm.

K. SANITARY SEWER

1. The Campus wastewater treatment system consists of the treatment plant, pumping stations, and the collection piping network. The entire sanitary sewer system flows into pumps and sewage is mechanically pumped to the treatment facility.

1.3 COMMON REQUIREMENTS

A. GENERAL REQUIREMENTS

- 1. Piping shall not be installed in, pass through, or enter the telecommunications room, except as needed to serve the room itself.
- 2. Piping shall not be installed above electrical panelboards, switchboards, switchgear, transformers, or safety disconnect switches.
- 3. See Section 23 05 13 in Division 23 for motor requirements.
- 4. Section Zone Valves: Union ball valves.
- 5. Pressure Gauges: Pressure or vacuum type as required.
- 6. Gas Outlets: See Vacuum System requirements above.
- 7. For maintenance and access requirements, refer to Part II Design Requirements, 'Access'.

1.4 PLUMBING VALVES

- A. General Requirements:
 - 1. Valves shall be located in readily accessible areas.
 - 2. Valves that are concealed are to be accessible via clearly marked access panels when located above or behind new or existing finished surfaces. Access panels shall be a minimum of 12 inches by 12 inches, or as needed for maintenance access.
 - 3. Each laboratory room shall have dedicated shut off valves.
- B. General Purpose Shut-off Valves:
 - 1. Performance Requirements: 2-piece, brass body, brass ball, brass stem with Teflon seats, threaded or flanged connection (depending on application)
 - 2. Products: Apollo, Milwaukee Hammond or equal.

22 05 23

22 05 13

- C. Pressure Reducing Valves:
 - 1. Performance Requirements: All brass, Teflon disc and diaphragm for hot water service
 - 2. Products: Watts, Wilkins, or equal.
- D. Fixture Shut-off Valves:
 - 1. Performance Requirements: All brass, quarter turn angle stops, threaded only
 - 2. Products: Brass Craft or equal
- E. Check Valves:
 - 1. Performance Requirements: All brass swing check or 1/2 lb. spring check type, threaded or flanged connection (depending on application).
 - 2. Products: Apollo, Milwaukee Hammond or equal.
- F. Bench Valves: Ball type with tapered sockets with ball and seat compatible with piping material.
- G. Laboratory Valves (air, gas, vacuum):
 - 1. Performance Requirements:
 - a. Laboratory grade with forged brass lever handles
 - b. Rotating chrome plated brass ball and molded RFE seals
 - c. Rated for use up to 75 psi
 - 2. Products: Water Saver, Chicago, T&S Brass, or equal

1.5 HANGERS AND SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

- A. ISOLATORS
 - 1. General Requirements: Provide felt or rubber lined hangers for non-insulated copper piping.

1.6 FACILITY DRAINAGE PIPING CLEANOUTS

- A. Cleanouts:
 - 1. General Requirements:
 - a. Make all cleanouts accessible.
 - b. If cleanouts are installed in an accessible ceiling space, the cleanout shall be extended through the floor above.
 - c. Use graphite on all cleanouts with all threads being thoroughly greased after acceptable pressure test.
 - d. Provide end of line clean outs on upper floor branch lines.
 - e. Performance Requirements by type: In Wall: Cast-iron body, brass plug with stainless steel cover.
 - f. In Floor or Grade: Adjustable, cast-iron body, brass plug and cover with gasket. Plug shall be installed within 1-inch of finished floor.

1.7 PLUMBING INSULATION

- A. Insulation is required at the following conditions:
 - 1. Water piping, 4-inches and smaller, exposed to the weather, including interior spaces subject to outside temperatures
 - 2. Domestic hot water piping
 - 3. Industrial hot water piping

22 07 00

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22 05 76

1.8 COMMISSIONING OF PLUMBING

A. GENERAL REQUIREMENTS

1. Commission the plumbing system in accordance with the University's Standard Specification Section 22 08 00 Commissioning of Plumbing System.

B. DISINFECTION OF WATER SYSTEMS

1. Disinfect all domestic hot and cold water systems in accordance with the University's Standard Specification Section 33 13 00 Disinfection of Water Utility Distribution Systems.

C. TESTS

- 1. Test only new piping.
- 2. Final connection between new and existing piping shall be tested at normal system operating pressures.
- 3. Make no test against a service valve or meter.
- 4. Isolate from the system all existing piping systems and new or existing equipment which may be damaged by test pressure. No loss in pressure or visible leaks shall show after 4 hours at the pressures indicated:

System Tested	Test Pressure PSI	Test with Sanitary &	
		<u>Lab</u>	
Sanitary and Lab, Waste, Drain, Vent	10 ft. head	Water	
Compressed Air	150 PSI	Air & Soap	
Deionized Water	100 PSI	Deionized Water	
Industrial and Domestic Hot & Cold Water	150 PSI*	Water	
Medical Gas	110 PSI	Air & Soap	
Natural Gas p.c. 1204.3.2	Low Pres: 10 PSI/15 min.		
	Med Pres: 60 PSI/30 min.		
Vacuum	110 PSI 27 inch vac.	Air & Soap	

*or 1.5 times the operational pressure, whichever is higher

1.9 DOMESTIC WATER DISTRIBUTION

A. General Requirements

- 1. The building plumbing systems shall have appropriate shut off valve zoning to allow for ease of maintenance with minimal shutdown impact to building occupants.
- 2. At minimum, shut off valves shall be provided for the following: each floor, each toilet room, each laboratory room, each equipment room, and each kitchen.

B. Piping

- 1. Above and below grade: Type L copper tubing
 - a. 1-1/2 inches and below: soft drawn
 - b. 2 inches and above: hard temper, cold drawn

C. Joints

1. All above grade piping, 2 inches and larger, and all below grade piping, regardless of size, shall be brazed with silver solder (silver/phosphorus).

D. Fittings

- 1. Copper tubing: Wrought copper or cast brass solder sweat type.
- E. Unions and Flanges

22 11 00

22 08 00

- 1. General Requirements:
 - a. Unions and flanges shall be provided at the inlet and outlet of all apparatus and equipment, at all valves, and elsewhere as required to facilitate removal of valves and equipment.
 - b. Flexible lines shall not be used in laboratories.
 - c. When connecting dissimilar metals, use brass nipples. Do not use devices with plastic components in contact with the flow stream.
 - d. 2 inches and smaller ground joint shall be cast brass unions.
 - e. 2-1/2 inches and larger shall be 150-lb flange, cast brass.
- F. Water Hammer Arrestors
 - 1. Performance Requirements:
 - a. Provide diaphragm type shock absorber, sized and located in accordance with Plumbing and Drainage Institute Manual WH-201.
 - b. Provide shut-off valves and access panels for arresters.
- G. VALVES
 - 1. General Requirements:
 - a. Valves shall be located in open, readily accessible areas, and laboratory utilities valves located in open, hallway outside each laboratory.
 - b. Valves that are concealed are to be accessible via clearly marked access panels no less than 24 by 24 inches square when valves and piping are concealed above or behind new or existing finished surfaces.
 - 2. Performance Requirements: Refer to Section 22 05 23

1.10 FACILITY SANITARY SEWERAGE

- A. General Requirements:
 - 1. All toilet rooms, laundry rooms and first floor trash rooms shall have floor drains.
 - 2. Sewer lines at toilet room vanities shall be designed properly with sweeps rather than "Ts" to allow for snaking when blockage occurs.
 - 3. No reducing couplings allowed.
 - 4. All floor drains and floor sinks shall be equipped with automatic trap priming systems. Flush valve trap primers should be used where a flush valve is near. Other drains should have electronic trap primers.
- B. Piping:
 - 1. General Requirements:
 - a. Service weight cast iron
 - b. Above or underground no hub waste piping must use 4-band couplings
 - c. No hub waste vent piping may utilize 2-band couplings
 - 2. Underground piping: no-hub or hub & spigot joined with compression gaskets.
 - 3. Above ground piping:
 - a. >2 inch no-hub with stainless steel and neoprene coupling.
 - b. <2 inch no-hub with stainless steel and neoprene couplings, or schedule 40 galvanized steel pipe joined with Durham type threaded drainage fittings.
- C. Piping: Same as above Section 22 13 00 Facility Sanitary Sewerage.
- D. Drains:
 - 1. General Requirements: cast iron, unless otherwise noted.
 - 2. Types:
 - a. Area drain: Cast iron top

22 13 00

- b. Roof and overflow drains: Cast iron with flange, flashing ring, gravel stop, underdeck clamp, extension, sump receiver, dome strainer, vandal proof, standpipe (overflow only).
- c. Floor drain: Cast iron body, N.B. top, with sediment bucket.

1.11 COMMERCIAL PLUMBING FIXTURES

22 42 00

- A. Bottle Filling Stations:
 - 1. General Requirements:
 - a. Provide at least one per building, located at the ground floor.
 - b. If drinking fountains are to be installed, provide a combined fountain/bottle filling station unit.
 - c. Individual bottle filling stations shall be installed at an accessible height.
 - d. Basin shall be designed to minimize splashing and standing water.
 - e. Refrigerated units to be provided if installed above the second floor or if piping passes through an unconditioned basement. Verify refrigeration requirements with the University's Representative.
 - 2. Performance Requirements: The unit shall be lead-free; contain bayonet style, non- proprietary, built-in filtration system; and shall include antimicrobial protection.
 - 3. Products: Elkay EZH20, Oasis Versacooler II, or equal.
- B. Water Closet:
 - 1. General Requirements:
 - a. Provide wall hung with cast iron floor mounted carrier or floor mount, depending on application.
 - b. Height of flushometer valve shall allow for maintenance in locations with ADA grab bar.
 - 2. Performance Requirements:
 - a. Provide vitreous china, siphon jet action, Maximum Performance (MaP) tested by IAPMO to exceed 500g capacity.
 - b. Flushometer: Exposed, diaphragm-type, manually operated, 1.28 gallons per flush (GPF). Contact University Representative for use of electronic sensing systems.
 - c. Seat: White, heavy-duty, commercial type, elongated, open front, solid plastic, with stainless steel hinge.
 - 3. Products:
 - a. Water closet: American Standard, or equal
 - b. Flushometer: Zurn, Sloan, or equal
- C. Urinals
 - 1. General Requirements:
 - a. Urinals shall be accessible.
 - b. For renovations, existing piping network shall be evaluated for size and slope.
 - 2. Performance Requirements:
 - a. Wall hung, ultra-low flow 0.125 GPF, vitreous white china with in wall carrier
 - b. Side discharge units are not acceptable.
 - c. Flushometer: Exposed, diaphragm-type, manually operated, ultra-low flow 0.125 GPF. Contact University Representative for use of electronic sensing systems.
 - 3. Products: Zurn, Sloan, or equal
- D. Wall-hung lavatory:
 - 1. General Requirements: Visible traps should be chrome plated unless the project requires special finishes.
 - 2. Performance Requirements:
 - a. 4-inch center vitreous china, with concealed carrier arm

- b. Sanitary waste traps for equipment shall be "P" type, 17 gauge, cast brass, slip joint nuts, chromeplated brass escutcheons, and cleanout plug.
- 3. Products: American Standard, or equal
- 4. Faucet: Manually operated, single control center set, 0.5 gpm, vandal resistant, pressure compensating multi-laminar spray. Contact University for use of electronic sensing systems.
- E. Sink, general purpose:
 - 1. Performance Requirements:
 - a. 18 gauge, type 304 stainless steel sink; 17 gauge chrome plated 1-1/2 inch by 1- 1/2 inch trap
 - b. Deck mounted low flow faucet, lever handle, gooseneck, rigid spout plain outlet.
 - 2. Products: Elkay, Just, or equal.
- F. Drain: 1-1/2 inch tailpiece, grid strainer.

1.12 COMPRESSED AIR SYSTEMS FOR LABORATORY FACILITIES

22 61 00

- A. Compressed air systems
 - 1. General Requirements:
 - a. Identify the design and installation requirements for compressed air quality, dew point, pressure, flow, and volume to meet project specific requirements.
 - b. Compressors shall be oil-type except for medical or dental applications. Refer to CDG Section 22 63 00 for Ultra-Pure system requirements.
 - c. Buildings utilizing compressed air for laboratory functions and HVAC systems shall have separate compressors.
 - d. Provide refrigerant dryers. In locations where refrigerant dryers cannot be used, consult the University's Representative. If desiccant dryers are to be used, they shall be capable of standby mode. Desiccant dryers shall not be used in small air compressor applications.
 - 2. Air Compressors
 - a. Provide lead/lag compressors for systems requiring 10 HP compressors or larger, i.e. split one 10 HP compressor into two 5 HP lead/lag compressors.
 - b. Provide inter-cooled and after cooled, 2 stage compressors/pumps for all 5 HP systems and larger.
 - c. Provide
 - d. Provide single stage compressors only for applications requiring 100 pounds or less.
 - e. Once through cooling water systems are prohibited.
 - 3. Compressed Air Piping:
 - a. Above ground: Type L copper tubing, hard drawn.
 - b. Below ground: Type K copper tubing, hard temper, cold drawn with brazed joints.
 - c. Joints: Silver brazing alloy, melting point above 1000 degrees F, 15 percent silver, 80 percent copper 5 percent phosphorous.
 - d. Fittings: Wrought copper or brass; solder sweat type. Couplings shall be of the staked stop type.
 - e. Valves: Ball type.
 - f. Lab Air Outlets: Line size, Ball valve or needle valves to match project requirements.
 - g. Points of connection to existing copper air piping in existing buildings shall be screwed, soldered, or brazed, depending on system.

1.13 VACUUM SYSTEMS FOR LABORATORY FACILITIES

- A. Vacuum Systems
 - 1. General Requirements: Identify the design and installation requirements for vacuum, pressure and flow to meet project specific requirements.
 - 2. Performance Requirements:

22 62 00

- a. Piping, Joints, Fittings, Valves, and Lab Air Outlets:
 - 1) See Compressed Air System requirements above.
- b. Vacuum Pump:
 - Furnish air-cooled duplex vacuum unit complete with base mounted pumps, tank drain, flexible connection, scrubber, check valves, relief valves, control panel including fused disconnect, vacuum switches and gauges, motors, starters, electrical alternator.
 - NEMA rating shall be specified based on the location of equipment.
- 3. Vacuum Pump Products: Ingersoll-Rand, or equal.

1.14 GAS SYSTEMS FOR LABORATORY FACILITIES

22 63 00

A. Specialty Gases

- 1. General Requirements:
 - a. This section applies to laboratories that require Ultra-Pure piping system for special gases including nitrogen, oxygen, CO2, Argon, etc.
 - b. Identify the design and installation requirements for quality, pressure and flow for all specialty gasses to meet project specific requirements.
 - c. Grounding: All oxygen, nitrous oxide and vacuum lines shall be grounded to the water supply system to reduce the possibility of static electric charges.
- 2. Performance Requirements:
 - a. Comply with NFPA 99 requirements for Gas and Vacuum Systems. Although this standard applies to Health Care systems, the requirements noted in this standard shall be applied for special lab air system.
 - b. Screwed Connections: Wherever possible, screwed joints made in attaching valves, or other permanently connected equipment shall be silver brazed after assembly using precautions to avoid overheating the valve or equipment. Where conditions do not permit this method of assembly, the connection joints shall be tinned or sweated with solder. No joint compound shall be used.
- 3. Products: Nitrogen and Argon: Plug Shutoff Valve; Circle Seal 9259 with Buna-N O- ring, or equal (no known equal).

END OF DIVISION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

- 1. Equipment identification
- 2. Valve identification
- 3. Piping identification
- 4. Signage

1.2 RELATED SECTIONS

- A. Section 220000
- B. Section 330526, Utility Line Signs, Markers, and Flags

1.3 REFERENCE STANDARDS

A. ANSI/ASME A13.1 – Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.
- C. Schedules:
 - 1. Valve identification chart and schedule, including valve numbering system, valve tag number location, function type, and valve manufacturer's name and model number.
 - 2. Lists of pipe and equipment to be labeled.
 - 3. Submit access door numbering scheme and schedule, including access door type, location, size and service.
 - 4. Include list of wording, symbols, letter size, letter style, and color coding for each system.

1.5 QUALITY ASSURANCE

- A. Coordinate color coding with the University's Representative for preferred color schemes and service abbreviations and valve and equipment numbering schemes prior to submittal review.
- B. Coordinate installation of identifying devices with completion of covering of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices, pipe identification and flow arrows before installing acoustical ceilings and similar concealment.
- E. Coordinate painting schemes of plumbing piping, if required, with University's Representative prior to submittal review.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer:

- 1. Brady/Seton
- 2. Stranco
- 3. Rowmark
- 4. Or equal

2.2 MANUFACTURER'S IDENTIFICATION

A. Manufacturer's nameplate, name, or trademark shall be permanently affixed to all equipment and material furnished under this Specification. The nameplates of the Subcontractor or Distributor are not acceptable.

2.3 EQUIPMENT IDENTIFICATION

- A. Properly identify each piece of equipment with nameplates mounted on or near each operations device, including:
 - 1. Main control and operating valves, safety devices
 - 2. Compressors
- B. Identify control panels and major control components outside panels with nameplates.
- C. Identify equipment that is out of view behind access doors in unfinished rooms on face of the access door.
- D. Small devices, such as inline pumps, may be identified with tags.
- E. Label content:
 - 1. Include equipment's Drawing designation or unique equipment number.
 - 2. Area served
 - 3. Year installed
 - 4. Make and model
 - 5. Equipment size / design capacity

2.4 NAMEPLATES

- A. Provide plastic labels for mechanical engraving with predrilled holes for attachment hardware.
 - 1. Material: rigid plastic laminated impact acrylic, 2 layer, exterior grade, UV stable
 - 2. Thickness: 1/16-inch, minimum
 - 3. Maximum label size: Length and width vary for required label content, but no less than 2 inches wide by 1 inch high.
 - 4. Background color:
 - a. Normal power: Black, matte finish
 - b. Emergency power: Red, matte finish
 - 5. Lettering: White, machine engraved, Futura font, 3/8 inch high, all caps
 - 6. Maximum temperature: Able to withstand up to 160 deg. F.
 - 7. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.
 - a. Mounting screw type to be #8- 18 x 1 /2 drilling or tapping style, 1/4 inch hex washer head, stainless steel, or similar, appropriate for material in which sign is affixed to. A bead of silicone sealer shall be applied on back of sign and at screw locations prior to affixing sign to equipment.
 - b. For signs larger than 3 inches by 3 inches, use a minimum of 4 mounting screws.

2.5 VALVE IDENTIFICATION

A. Attached to stem of each control valve and line shutoff valve installed under Division 22, with No. 16 brass chain, color-coded plastic laminate tag. Engrave laminate tags with 1-inch designated numbers in accordance with typed schedule showing valve size, locations, service, similar to the following form:

RW: 3-inches Shutoff, Toilets 3rd Floor Column F-8

- 1. Engrave identification tags "normally open" (green) or "normally closed" (red).
- 2. Do not identify valves where the use is obvious, such as equipment isolation valves.
- 3. Tag all valves except fixture stops.
- 4. Label plumbing valves "Plbg" plus valve identification number.
- 5. Number tags to conform to directory listing number, location, and use.
- B. Access panel markers: Provide manufacturer's standard 1/16 inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8 inch center hole to allow attachment.

2.6 PAINTED IDENTIFICATION MATERIALS

- A. Stencils: Standard fiberboard stencils, prepared for required applications with the letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 3/4 inch high letters for access door signs and similar operational instructions.
- B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- C. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

2.7 PIPE IDENTIFICATION

- A. General requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Small pipes: For external diameters less than 6 inches (including isolation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Adhesive lap joint in pipe marker overlap.
 - 3. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inches.
- D. Pipe Label Contents: Include identification of piping service using piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application. Include 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.
- E. Locate pipe markers as follows:
 - 1. Within one foot of each valve, fitting, thermometer or gauge (except on plumbing fixtures).
 - 2. At each branch or riser take off.

- 3. At each passage through walls, floors and ceiling construction.
- 4. At each pipe passage to underground.
- 5. On all horizontal pipe runs every 20 ft, at least twice in each room and each story traversed by piping system.
- 6. Identify piping contents, flow direction, supply and return.
- 7. Where capped piing is provided for future connections, provide legible and durable tags indicating symbol identification.
- 8. At wall and ceiling access panels.
- 9. Practicable variations or changes in locations and spacing may be made with specific approval of the University's Representative to meet specific conditions.

2.8 UNDERGROUND TYPE PLASTIC WARNING TAPE LINE MARKER

A. Refer to Section 330526

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.
- B. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPE SYSTEM IDENTIFICATION

- A. General: Provide for all systems unless indicated otherwise.
- 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. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 2. Near major equipment items and other points of origination and termination.
 - 3. 50 feet intervals.
- C. Types: Install pipe markers of one of the following types on each system, and include arrows to show normal direction of flow:
 - 1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2 inches beyond ends of lettering.
 - 2. Stenciled markers, with lettering color complying with ANSI A13.1.
 - 3. Plastic pipe markers, with application system as indicated under "Materials" in this Section. Install on pipe insulation segment where required for hot non-insulated pipes.
 - 4. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.
- D. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device. Within one foot of each valve, fitting, thermometer or gauge (except on plumbing fixtures).
 - 2. At each branch or riser take off, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

- 3. At each passage through walls, floors and ceiling construction, or enter non-accessible enclosures.
- 4. At each pipe passage to underground.
- 5. At access doors, manholes and similar access points which permit view of concealed piping. At wall and ceiling access panels. Practicable variations or changes in locations and spacing may be made with specific approval of the University's Representative to meet specific conditions.
- 6. Near major equipment items and other points of origination and termination.
- 7. Spaced intermediately at maximum spacing of 50 feet (15m) along each piping run, except reduce spacing to 25 feet (8 m) in congested areas of piping and equipment.
- 8. On all horizontal pipe runs every 20 ft, at least twice in each room and each story traversed by piping system.
- 9. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 10. Where capped piping is provided for future connections, provide legible and durable tags indicating symbol identification.
- 11. Identify piping contents, flow direction, supply and return.
- E. During back-filling/top soiling of exterior underground piping systems, install continuous underground-type plastic line marker, locate directly over buried line at 12-inches above pipe. Use metallic lined plastic line markers for non-metallic type piping.

3.3 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve cock and control device in each piping system; exclude check valves, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
- B. Valves Concealed in Suspended Ceilings: Provide 1/4 inch high plastic tape marker identifying the valve number on the nearest ceiling grid member.

3.4 PLUMBING EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device.
 - 1. Signs shall be placed on the equipment in a logical location, easily visible to maintenance personnel, e.g. near control panels, disconnect switches, nameplates, on or near equipment main access doors and panels, etc. Sign and drilling locations shall be approved by the University's Representative.
- B. Optional sign types: Where lettering larger than 1 inch height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, verify with University's Representative.
- C. Lettering size: Minimum 1/4 inch high lettering for name of unit where viewing distances less than 24 inches, 1/2 inch high for distances up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- D. Plasticized tags: Where equipment to be identified is concealed above acoustical ceilings or similar concealment, use plasticized tags installed within concealed space to eliminate text in exposed sign (outside concealment). In rooms other than security area, mechanical rooms, storage, etc. use thumbtacks for exposed signs with color coded for each type of equipment. Verify with University's Representative.

3.5 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any plumbing identification device which has become visually blocked by Work of this Division or other Divisions.
- B. Cleaning: Clean face of identification devices.

3.6 EXTRA STOCK

- A. Furnish minimum of 5% extra stock of each plumbing identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
 - 1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric motors.
 - 2. Motor starters.
 - 3. Gauges.
 - 4. Thermometers.
 - 5. Access Doors.
 - 6. Flexible joints.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 23 Section.
- C. Refer to Section 230800.13, T-24 Commissioning of HVAC for Title 24 commissioning requirements.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.
- C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
 - 1. AABC Associated Air Balance Council
 - 2. AFBMA Anti Friction Bearing Manufacturer's Association
 - 3. AMCA Air Moving and Control Association Inc.
 - a. Standard 210 Laboratory Methods of Testing Fans
 - 4. ANSI American National Standards Institute
 - 5. ARI Air-Conditioning and Refrigeration Institute
 - 6. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
 - 7. ASME American Society of Mechanical Engineers
 - 8. ASTM American Society for Testing and Materials
 - 9. CCR California Code of Regulations
 - a. Title 8 Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
 - 10. CSA Canadian Standards Association International
 - 11. CSFM California State Fire Marshal
 - 12. NCPWB National Certified Pipe Welding Bureau

- 13. NIST National Institute of Standards and Technology
- 14. NEMA National Electrical Manufacturers' Association
- 15. NFPA National Fire Protection Association
- 16. OSHA Occupational Safety and Health Act
- 17. SMACNA Duct Manuals
- 18. UL Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
 - 1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2022.
 - b. California Electrical Code, 2022.
 - c. California Energy Code, 2022.
 - d. California Fire Code, 2022.
 - e. California Green Building Standards Code, 2022.
 - f. California Mechanical Code, 2022.
 - g. California Plumbing Code, 2022.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - I. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
 - 2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
 - 2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 - 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
 - 4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

- B. Arrange for utility connections and pay charges incurred, including excess service charges.
- C. Coordination:
 - 1. General:
 - a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
 - 2. Electrical Coordination:
 - a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
 - 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
 - 3. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.
- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
 - 1. Partial or incomplete submittals will not be considered.
 - 2. Quantities are Contractor's responsibility and will not be reviewed.
 - 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 - Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 - 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 - 6. Organize submittals in same sequence as in Specification Sections.
 - 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

- a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
- b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
- c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
- d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.
 - Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.
- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
- D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, restraints, and vibration isolators shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an HCAI preapproved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to

show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

- b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with California Building Code
- 4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

- A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.
- B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.
- C. Check, Test, and Start forms, from equipment manufacturers.
- D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
 - 6) Copies of guarantees/warrantees for each item of equipment or systems.
 - 7) Test data and system balancing reports.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Temperature control diagrams and literature.
 - 11) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
 - 12) Commissioning and Preliminary Operation Tests required as part of the Work.
 - 2. Post service telephone numbers and addresses in an appropriate place designated by Architect.
- B. Record Drawings:
 - 1. Refer to Division 01 for additional requirements.
 - 2. Upon completion of the Work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.

- d. Provide Contractor's signature, verifying accuracy of record drawings.
- e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.
- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.
- G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.
- C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.
- D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect.

Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

- A. No material installed as part of this Work shall contain asbestos.
- B. California Green Building Code Compliance:
 - 1. HVAC and refrigeration equipment shall not contain CFCs.
 - 2. HVAC and refrigeration equipment shall not contain Halons.

2.3 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected

loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

- Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.
- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
 - 1. Multispeed motors shall have separate windings for each speed.
- D. Polyphase Motors with Additional Requirements:
 - 1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 - 2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
 - 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- E. Single-Phase Motors:
 - 1. Select motors with service factor of 1.15.
 - 2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
 - 3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:
 - a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.
 - 1) Exceptions:
 - a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
 - b) Motors installed in space conditioning equipment certified under California Energy Code Section 110.1 or 110.2.
 - 4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
 - 5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
 - 6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
 - 7. Motors 1/20 HP and Smaller: Shaded-pole type.

8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
 - 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 - 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
 - 3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
 - 4. Provide OSHA label indicating the device starts automatically.

2.5 GAUGES

- A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.6 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 - 1. Provide extension for insulation.
 - 2. Provide thermometers with steel bulb chambers and brass separable sockets.
 - 3. Thermometers for air temperature shall have 8 inch minimum stem.
- B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.
- C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.7 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

- 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.
- E. Provide insulated doors where located in internally insulated ducts or casings.
- F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.8 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.
- B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.9 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.10 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.11 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legend and flow arrow shall conform to ASME A13.1.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS:

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.
- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

3.2 FRAMING, CUTTING, AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.
- E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 MECHANICAL DEMOLITION

- A. Refer to Division 01 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic 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.

3.6 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.
 - 2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
 - 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 EXCAVATING

- A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.
- B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE

gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

- C. Maintain all warning signs, barricades, flares, and red lanterns as required.
- D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.8 BACKFILLING

- A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.
- B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
 - 1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.
- C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.
- D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.9 UNION AND FLANGE INSTALLATION

- A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.
- B. Install unions in piping NPS 2" and smaller 3 or flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.
- C. Locate the unions for easy removal of the equipment, tank, or valve.
- D. Do not install unions or flanges in refrigerant piping systems.

3.10 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.11 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.
- B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.12 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-I0 or V-20", "Scotchwrap 50", Slipknot I00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.
 - 1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.13 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer's recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.
- B. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.
- C. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.

D. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.14 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test the installations in accordance with the following requirements and applicable codes:
 - 1. Notify the Architect at least seven days in advance of testing.
 - 2. Authority having jurisdiction shall witness tests of piping systems.
 - 3. Piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.
 - 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 - 5. Isolate from system equipment that may be damaged by test pressure.
 - 6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.
 - a. Authority having jurisdiction shall witness final connection to system.
- C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

System Tested	Test Pressure PSI	Test With
All Hot, Chilled, Combination, Condenser Water Piping	Greater of 1-1/2 x WP or 100 psi	Water

- D. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:
 - Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4 mm (4000 microns) and hold for 30 minutes. Break to 5 psig with dry nitrogen and allow to remain in the system for ten minutes. Evacuate to 2 mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.
 - 2. At the end of the evacuation, if the system has been proved leak-free, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.
 - 3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

3.15 OPERATION OF SYSTEMS

- A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:
 - 1. Complete all requirements listed under "Check, Test and Start Requirements."
 - 2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 - 3. Filters, strainers etc. are in place.
 - 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 - 5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.16 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is gualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 - 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 - 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.17 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
 - 1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
 - 2. Correct rotation of motors and ratings of overload heaters are verified.
 - 3. Specified filters are installed and spare filters have been turned over to Owner.
 - 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 - 5. All equipment has been cleaned, and damaged painted finishes touched up.
 - 6. Damaged fins on heat exchangers have been combed out.
 - 7. Missing or damaged parts have been replaced.
 - 8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 - 9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 - 10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 - 11. Preliminary test and balance work is complete, and reports have been forwarded for review.
 - 12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 - 13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
 - 1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.

- 2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
- 3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
- 4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
- 5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Before handing over the system to Owner replace all filters with complete new set of filters.
- D. Review of Contractor's Tests:
 - 1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- E. Test Logs:
 - 1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.
- F. Preliminary Operation:
 - 1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.
- G. Operational Tests:
 - 1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
 - 2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
 - 3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
 - 4. Control systems shall be completely operable with settings properly calibrated and adjusted.
 - 5. Rotating equipment shall be in dynamic balance and alignment.
 - 6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

3.18 DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
 - 1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
 - 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.

- c.
- Date(s) of training. List of topics covered in training sessions. d.
- 4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes:
 - 1. Equipment identification
 - 2. Valve, automatic control valves, dampers (including smoke and combination fire/smoke dampers) and automatic control dampers identification
 - 3. Piping and ductwork identification
 - 4. Signage

1.2 RELATED SECTIONS

- A. Section 230000
- B. Section 330526, Utility Line Signs, Markers, and Flags

1.3 REFERENCE STANDARDS

A. ANSI/ASME A13.1 – Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.
- C. Schedules:
 - Valve identification chart: Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.
 - 2. Lists of pipe and equipment to be labeled.
 - 3. Submit access door numbering scheme and schedule, including access door type, location, size and service.
 - 4. Include list of wording, symbols, letter size, letter style, and color coding for each system.

1.5 QUALITY ASSURANCE

- A. Coordinate color coding with the University's Representative for preferred color schemes and service abbreviations and valve and equipment numbering schemes prior to submittal review.
- B. Coordinate installation of identifying devices with completion of covering of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices, pipe identification and flow arrows before installing acoustical ceilings and similar concealment.

E. Coordinate painting schemes of piping, if required, with University's Representative prior to submittal review.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer:
 - 1. Brady/Seton
 - 2. Stranco
 - 3. Rowmark
 - 4. Or equal

2.2 MANUFACTURER'S IDENTIFICATION

A. Manufacturer's nameplate, name, or trademark shall be permanently affixed to all equipment and material furnished under this Specification. The nameplates of the Subcontractor or Distributor are not acceptable.

2.3 EQUIPMENT IDENTIFICATION

- A. Properly identify each piece of equipment with nameplates mounted on or near each operations device, including:
 - 1. Main control and operating valves, safety devices, and hazardous units
 - 2. Pumps, compressors, and similar motor-driven units
 - 3. Expansion tanks, air separators, water treatment equipment, and similar equipment.
 - 4. Air handling equipment, fans, coils, fancoil units, unit heaters, filters, sound attenuators, and VAV terminal units
 - 5. Chillers and large refrigeration units
 - 6. Provide identification of each VAV terminal unit and each room temperature sensor, using the same address nomenclature as established by the controls contractor.
- B. Identify control panels and major control components outside panels with nameplates.
- C. Identify equipment that is out of view behind access doors in unfinished rooms on face of the access door.
- D. Label content:
 - 1. Include equipment's Drawing designation or unique equipment number. Use same address nomenclature established in the energy management system.
 - 2. Area served
 - 3. Year installed
 - 4. Make and model
 - 5. Equipment size (in CFM, HP, RPM, etc.)
 - 6. If on emergency power, indicate source of power

2.4 NAMEPLATES

- A. Provide plastic labels for mechanical engraving with predrilled holes for attachment hardware.
 - 1. Material: rigid plastic laminated impact acrylic, 2 layer, exterior grade, UV stable
 - 2. Thickness: 1/16-inch, minimum
 - 3. Maximum label size: Length and width vary for required label content, but no less than 2 inches wide by 1 inch high.
 - 4. Background color:
 - a. Normal power: Black, matte finish
 - b. Emergency power: Red, matte finish
- 5. Lettering: White, machine engraved, Futura font, 3/8 inch high, all caps
- 6. Maximum temperature: Able to withstand up to 160 deg. F.
- 7. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.
 - a. Mounting screw type to be #8- 18 x 1 /2 drilling or tapping style, 1/4 inch hex washer head, stainless steel, or similar, appropriate for material in which sign is affixed to. A bead of silicone sealer shall be applied on back of sign and at screw locations prior to affixing sign to equipment.
 - b. For signs larger than 3 inches by 3 inches, use a minimum of 4 mounting screws.

2.5 VALVE TAGS

A. Attached to stem of each control valve and line shutoff valve installed under Division 22, with No. 16 brass chain, color-coded plastic laminate tag. Engrave laminate tags with 1-inch designated numbers in accordance with typed schedule showing valve size, locations, service, similar to the following form:

RW: 3-inches Shutoff, Toilets 3rd Floor Column F-8

- 1. Engrave identification tags "normally open" (green) or "normally closed" (red).
- 2. Do not identify valves where the use is obvious, such as equipment isolation valves.
- 3. Tag all valves except fixture stops.
- 4. Label HVAC valves "HVAC" plus valve identification number.
- 5. Number tags to conform to directory listing number, location, and use.
- B. Access panel markers: Provide manufacturer's standard 1/16 inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8 inch center hole to allow attachment.

2.6 PAINTED IDENTIFICATION MATERIALS

- A. Stencils: Standard fiberboard stencils, prepared for required applications with the letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than3/4 inch high letters for access door signs and similar operational instructions.
- B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- C. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

2.7 PIPE IDENTIFICATION

- A. General requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Small pipes: For external diameters less than 6 inches (including isolation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Adhesive lap joint in pipe marker overlap.
 - 3. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inches.

- D. Pipe Label Contents: Include identification of piping service using piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application. Include 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.
- E. Locate pipe markers as follows:
 - 1. Within one foot of each valve, fitting, thermometer or gauge.
 - 2. At each branch or riser take off.
 - 3. At each passage through walls, floors and ceiling construction.
 - 4. At each pipe passage to underground.
 - 5. On all horizontal pipe runs every 20 ft, at least twice in each room and each story traversed by piping system.
 - 6. Identify piping contents, flow direction, supply and return.
 - 7. Where capped piing is provided for future connections, provide legible and durable tags indicating symbol identification.
 - 8. At wall and ceiling access panels.
 - 9. Practicable variations or changes in locations and spacing may be made with specific approval of the University's Representative to meet specific conditions.

2.8 UNDERGROUND TYPE PLASTIC WARNING TAPE LINE MARKER

A. Refer to Section 330526

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.
- B. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK INSTALLATION

- A. Access doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
- B. Concealed doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification in lieu of specified signs.
- C. Access doors for fire/smoke dampers: Permanently identify on the exterior by a label with letters not less than 1/2 inch in height reading "FIRE/SMOKE DAMPER".

3.3 PIPE SYSTEM IDENTIFICATION

A. General: Provide for all systems unless indicated otherwise.

- 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. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 2. Near major equipment items and other points of origination and termination.
 - 3. 50 feet intervals.
- C. Types: Install pipe markers of one of the following types on each system, and include arrows to show normal direction of flow:
 - 1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2 inches beyond ends of lettering.
 - 2. Stenciled markers, with lettering color complying with ANSI A13.1.
 - 3. Plastic pipe markers, with application system as indicated under "Materials" in this Section. Install on pipe insulation segment where required for hot non-insulated pipes.
 - 4. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.
- D. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device. Within one foot of each valve, fitting, thermometer or gauge.
 - 2. At each branch or riser take off, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - 3. At each passage through walls, floors and ceiling construction, or enter non-accessible enclosures.
 - 4. At each pipe passage to underground.
 - 5. At access doors, manholes and similar access points which permit view of concealed piping. At wall and ceiling access panels. Practicable variations or changes in locations and spacing may be made with specific approval of the University's Representative to meet specific conditions.
 - 6. Near major equipment items and other points of origination and termination.
 - 7. Spaced intermediately at maximum spacing of 50 feet (15m) along each piping run, except reduce spacing to 25 feet (8 m) in congested areas of piping and equipment.
 - 8. On all horizontal pipe runs every 20 ft, at least twice in each room and each story traversed by piping system.
 - 9. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
 - 10. Where capped piping is provided for future connections, provide legible and durable tags indicating symbol identification.
 - 11. Identify piping contents, flow direction, supply and return.
- E. During back-filling/top soiling of exterior underground piping systems, install continuous underground-type plastic line marker, locate directly over buried line at 12-inches above pipe. Use metallic lined plastic line markers for non-metallic type piping.

3.4 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve cock and control device in each piping system; exclude check valves, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
- B. Valves Concealed in Suspended Ceilings: Provide 1/4 inch high plastic tape marker identifying the valve number on the nearest ceiling grid member.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device.

- 1. Signs shall be placed on the equipment in a logical location, easily visible to maintenance personnel, e.g. near control panels, disconnect switches, nameplates, on or near equipment main access doors and panels, etc. Sign and drilling locations shall be approved by the University's Representative.
- B. Optional sign types: Where lettering larger than 1 inch height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, verify with University's Representative.
- C. Lettering size: Minimum 1/4 inch high lettering for name of unit where viewing distances less than 24 inches, 1/2 inch high for distances up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- D. Plasticized tags: Where equipment to be identified is concealed above acoustical ceilings or similar concealment, use plasticized tags installed within concealed space to eliminate text in exposed sign (outside concealment). In rooms other than security area, mechanical rooms, storage, etc. use thumbtacks for exposed signs with color coded for each type of equipment. Verify with University's Representative.

3.6 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by Work of this Division or other Divisions.
- B. Cleaning: Clean face of identification devices.

3.7 EXTRA STOCK

- A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
 - 1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - c. Multizone systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES AND STANDARDS

- A. Associated Air Balance Council (AABC)
 - 1. National Standards for Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB)
 - 1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.4 DEFINITIONS

- A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.
- B. Similar Terms: The following table is provided for clarification only:

<u>Similar Terms</u>			
Contract Term	AABC Term	NEBB Term	
TAB Specialist	TAB Agency	NEBB Certified Firm	
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems	

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TAB Supervisor	Field	Test and Balance Engineer	Test and Balance Supervisor

- C. AABC: Associated Air Balance Council.
- D. NEBB: National Environmental Balancing Bureau.
- E. TAB: Testing, adjusting, and balancing.
- F. TAB Organization: Body governing practices of TAB Specialists.
- G. TAB Specialist: An entity engaged to perform TAB Work.

1.5 ACTION SUBMITTALS

A. For additional requirements, refer to Section 230050, Basic HVAC Materials and Methods.

1.6 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 230050, Basic HVAC Materials and Methods.
- B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
 - 1. Provide list of similar projects completed by proposed TAB field supervisor.
 - 2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.
- C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
 - 1. Submit examinations report with qualifications data.
- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and stepby-step procedures as specified in "Preparation" Article.
- E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.
- F. Certified TAB reports.
 - 1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.
- G. Sample report forms.
- H. 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.
 - a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.7 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 230050, Basic HVAC Materials and Methods.
- B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.8 QUALITY ASSURANCE

- A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.
- B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:
 - 1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
 - a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
 - 2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
 - a. TAB technician shall have minimum 4 years TAB field experience.
- C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.
- D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.
- E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
 - 1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.
- F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.
- G. TAB Standard:
 - 1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
 - a. AABC National Standards for Total System Balance, or
 - b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - 2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
 - 3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.
- H. Certify TAB field data reports and perform the following:

- 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
- 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- I. TAB Report Forms: Use standard TAB specialist's forms approved by Architect .
- J. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.9 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.10 WARRANTY

- A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
 - 1. AABC Performance Guarantee.
 - 2. NEBB Quality Assurance Program.
- B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- C. Coordinate TAB work with work of other trades.
- PART 2 PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contract Documents Examination Report:
 - 1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
 - a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
 - b. Proposed corrective action necessary for proper system operation.
- B. 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.
- C. Examine the approved submittals for HVAC systems and equipment.

- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine 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.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. 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.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report conditions requiring correction discovered before and during performance of TAB procedures.
- N. 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 strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:
 - 1. General description of each air system and sequence(s) of operation.
 - 2. Complete list of measurements to be performed.
 - 3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
 - 4. Qualifications of personnel assigned to Project.
 - 5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.
 - 6. Air terminal correction factors for the following:
 - a. Air terminal configuration.
 - b. Flow direction (supply or return/exhaust).
 - c. Effective area of each size and type of air terminal.
 - d. Air density.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

8. Windows and doors can be closed so indicated conditions for system operations can be met.

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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation." Section 238000 Heating, Ventilating, and Air Conditioning."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speedcontrol 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. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.
- C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.
 - 1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
 - 2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.
- D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.
- E. For variable-air-volume systems, develop a plan to simulate diversity.
- F. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- G. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- I. Verify that motor starters are equipped with properly sized thermal protection.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.
- L. Check condensate drains for proper connections and functioning.

- M. Check for proper sealing of air-handling-unit components.
- N. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts." Section 238000 "Heating, Ventilating, and Air Conditioning."
- O. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.
- P. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

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.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.
- C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

- D. 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. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- E. Measure air outlets and inlets without making adjustments.
 - Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet
 manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used
 due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not
 been obtained by direct measurement.
- F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. 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, if included.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.
- G. Do not overpressurize ducts.

3.6 PROCEDURES FOR DUAL-DUCT SYSTEMS

- A. Comply with applicable requirements for constant-volume air systems in addition to those listed below.
- B. Verify that the cooling coil is capable of full-system airflow, and set mixing boxes at full-cold airflow position for fan volume.
- C. Measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
 - 1. If insufficient static pressure exists, increase airflow at the fan.
- D. Test and adjust the constant-volume mixing boxes as follows:
 - 1. Verify both hot and cold operations by adjusting the thermostat and observing changes in air temperature and volume.
 - 2. Verify sufficient inlet static pressure before making volume adjustments.
 - 3. Adjust mixing boxes to indicated airflows within specified tolerances. Measure airflow by Pitot-tube traverse readings or by measuring static pressure at mixing-box taps if provided by mixing-box manufacturer.
- E. Remeasure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
- F. Adjust variable-air-volume, dual-duct systems in the same way as constant-volume, dual-duct systems; adjust maximum- and minimum-airflow setting of each mixing box.

3.7 PROCEDURES FOR MULTIZONE SYSTEMS

- A. Comply with applicable requirements for constant-volume air systems in addition to those listed below.
- B. Set unit at maximum airflow through the cooling coil.
- C. Adjust each zone's balancing damper to achieve indicated airflow within the zone.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Complete air balance prior to hydronic systems balancing.
- B. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed ranges given in article, Tolerances.
- C. Prepare schematic diagrams of systems' "as-built" piping layouts.
- D. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check liquid level in expansion tank.
 - 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 232123 "Hydronic Pumps."
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 - 4. Report flow rates that are not within ranges given in article, Tolerances.
- B. Venturies and calibrated orifices with portable or permanent flow meters shall be used to balance the water flows. When such components have not been installed, measure temperature differential across coils or other elements and balance accordingly.

- C. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- D. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- E. Set calibrated balancing valves, if installed, at calculated presettings.
- F. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- G. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- H. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - Record settings and mark balancing devices.
- I. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- J. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- K. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.
- 3.11 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS
 - A. Balance the primary circuit flow first and then balance the secondary circuits.
- 3.12 PROCEDURES FOR MOTORS
 - A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter manufacturer's name, model number, size, type, and thermal-protection-element rating.
 - a. Starter strip heater size, type, and rating.
 - B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the condition of filters.
 - 4. Check the condition of coils.
 - 5. Check the operation of the drain pan and condensate-drain trap.
 - 6. Check bearings and other lubricated parts for proper lubrication.
 - 7. Report on the operating condition of the equipment and the results of the measurements taken. Report conditions requiring correction.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Conditions requiring correction noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.14 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: Plus 10 percent and minus 0 percent .
 - 2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent .
 - Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for "Air Outlets and Inlets".
 - 4. Heating-Water Flow Rate: Plus or minus 10 percent .
 - 5. Cooling-Water Flow Rate: Plus or minus 10 percent .
- B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.15 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 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 field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
 - 2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
 - 3. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Project Performance Guaranty
 - 6. Architect's name and address.
 - 7. Engineer's name and address.
 - 8. Contractor's name and address.
 - 9. Report date.
 - 10. Signature of TAB supervisor who certifies the report.
 - 11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 12. 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.
 - 13. Nomenclature sheets for each item of equipment.
 - 14. 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.
- D. 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 and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

- E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.
- F. Test Reports General:
 - 1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.
- G. Apparatus-Coil Test Reports:
 - 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - I. Refrigerant expansion valve and refrigerant types.
 - m. Inlet steam pressure in psig.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):

- Total airflow rate in cfm. a.
- b. Total system static pressure in inches wg.
- C. Fan rpm.
- Discharge static pressure in inches wg. d.
- Suction static pressure in inches wg. e
- Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct I. cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - Traverse air temperature in deg F. C.
 - Duct static pressure in inches wg. d.
 - e. Duct size in inches.
 - Duct area in sq. ft.. f.
 - Indicated air flow rate in cfm. g.
 - Indicated velocity in fpm. h.
 - i. Actual air flow rate in cfm.
 - Actual average velocity in fpm. j.
 - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:
 - 1. Unit Data:
 - System and air-handling unit identification. a.
 - b. Location and zone.
 - Apparatus used for test. C.
 - d. Area served.
 - Make. e.
 - f. Number from system diagram.
 - Type and model number. g.
 - Size. h.
 - Effective area in sq. ft. i.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - Air velocity in fpm. b.
 - Preliminary air flow rate as needed in cfm. C.
 - d. Preliminary velocity as needed in fpm.
 - Final air flow rate in cfm. e.
 - f. Final velocity in fpm.
 - Space temperature in deg F. g.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - 1. Unit Data:
 - System and air-handling-unit identification. a.
 - b. Location and zone.
 - Room or riser served. C.
 - d. Coil make and size.
 - Flowmeter type. e.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - Entering-water temperature in deg F. b.
 - Leaving-water temperature in deg F. C.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - Leaving-air temperature in deg F. f.

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

3.17 INSPECTIONS

- A. Initial Inspection:
 - 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 Inspection:
 - 1. After initial inspection 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 inspection be made by Architect .
 - 2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect .
 - 3. Architect 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 10 percent, 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.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
 - 1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
 - 3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.
- D. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for commissioning of HVAC systems for Title 24 (T-24) compliance.
- B. Scope: Commissioning Coordinator shall complete the building systems commissioning requirements of the California Energy Code, as applicable to Project. It is not the intention of Project specifications to require duplication in testing.
 - 1. T-24 commissioning activities may be coordinated with Contractor tests and TAB work specified in technical Sections.
 - 2. T-24 commissioning activities may be coordinated with LEED and CHPS program commissioning activities, as applicable to Project.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The requirements of this Section apply to all Sections of Division 23.
- C. In the event of conflict between requirements of Division 01 Title 24 commissioning specifications and this Section, Division 01 requirements shall prevail.

1.3 REFERENCES

- A. 2016 California Energy Code.
- B. 2016 California Energy Code and Building Energy Efficiency Standards Reference Appendices.
- C. 2016 Building Energy Efficiency Standards Nonresidential Compliance Manual.

1.4 DEFINITIONS

- A. Commissioning Coordinator: General Contractor, or an entity engaged by the General Contractor to perform T-24 commissioning.
- B. Covered Processes: Process equipment for which there are listed requirements in the California Energy Code.
- C. OPR: Owner's Project Requirements.
- D. TAB: Testing, Adjusting, and Balancing.

1.5 SUBMITTALS (FOR RECORD ONLY)

- A. Submit the following:
 - 1. Commissioning Plan.
 - 2. Systems Manual.
 - 3. Commissioning Report.
 - 4. Certificates of Installation.
 - 5. Certificates of Acceptance.

B. Above items for inclusion in closeout documents submitted to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 TEST INSTRUMENTS

A. Commissioning Coordinator shall supply test instruments. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if recommended by instrument manufacturer, and be checked for accuracy prior to start of work.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

- A. Architect/Engineer:
 - 1. Performs construction observation. Provides construction observation reports.
 - 2. Reviews and approves Commissioning Plan, Systems Manual, and Commissioning Report.
 - 3. Assists in problem resolution.
- B. Commissioning Coordinator:
 - 1. Coordinates commissioning process.
 - 2. Develops Commissioning Plan.
 - 3. Schedules and conducts functional testing. Completes Certificates of Acceptance.
 - 4. Assembles Systems Manual.
 - 5. Schedules and conducts systems operations training. Verifies systems operations training completion.
- C. HVAC Subcontractor: Assists in functional testing.
- D. Electrical Subcontractor: Assists in functional testing.
- E. Controls Subcontractor: Assists in functional testing.
- F. TAB Subcontractor: Assists in functional testing.
- G. Equipment Manufacturers/Vendors:
 - 1. Performs Check, Test, and Start of equipment and systems, as required by Project technical Sections.
 - 2. Provides systems and equipment documentation required to complete functional testing and assemble Systems Manual.

3.2 COMMISSIONING PLAN

- A. Commissioning Coordinator shall author the code-required Commissioning Plan. The Commissioning Plan shall address HVAC systems for which commissioning is required. The Commissioning Plan shall be updated by Commissioning Coordinator throughout the construction process. The Commissioning Plan shall contain the following:
 - 1. General Project Information: Commissioning Coordinator shall obtain general Project information from Project architectural Drawings.
 - 2. Commissioning Goals:
 - a. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.

- b. Verify and document proper integrated performance of equipment and systems utilizing functional testing for mechanical system acceptance, as required by the California Energy Code.
- c. Verify that Systems Manual documentation is complete.
- d. Verify that operating personnel are trained to enable them to operate, monitor, adjust, and maintain HVAC systems in an effective and energy-efficient manner.
- 3. Commissioning Coordinator shall compile the following information and include in Commissioning Plan:
 - a. An explanation of original design intent: Commissioning Coordinator shall obtain copies of the OPR and BOD for the Project.
 - b. Equipment and systems to be tested, including the extent of tests: Test 100 percent of a given type of installed equipment having associated Acceptance Requirements.
 - 1) Refer to forms MCH-01-E on Drawings for systems to be commissioned.
 - Covered Processes: In addition to systems listed in MCH-01-E on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:
 - a) Parking garage ventilation systems.
 - b) Compressed air systems.
 - c) Type 1 Kitchen exhaust systems.
 - c. Functions to be tested: Refer to 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Nonresidential Appendix NA7.
 - d. Conditions under which the test shall be performed.
 - e. Measureable criteria for acceptable performance: Refer to 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Nonresidential Appendix NA7.
 - f. Commissioning team information:
 - Refer to Project information on architectural Drawings for design team participants. Commissioning Coordinator shall add subcontractor information to provided design team information and include in Commissioning Plan.
 - g. Commissioning process activities, schedules, and responsibilities. Plans for the completion of functional performance testing, systems operations training, and commissioning report.

3.3 CERTIFICATES OF INSTALLATION

A. Commissioning Coordinator shall complete applicable Certificates of Installation forms.

3.4 FUNCTIONAL TESTING REQUIREMENTS

- A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests and complete the appropriate "Certificates of Acceptance." Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 238000, "Heating, Ventilating, and Air Conditioning," Article, "Ductwork Sealing and Leak Testing."
 - 1. Covered Processes: In addition to systems listed on T-24 compliance forms on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:
 - a. Parking garage ventilation systems.
 - b. Compressed air systems.
 - c. Type 1 Kitchen exhaust systems.

3.5 SYSTEMS MANUAL

A. Commissioning Coordinator shall assemble Systems Manual in accordance with the requirements of the California Energy Code, HVAC and Plumbing specifications, and Division 01 specifications, including Section 017900, Demonstration and Training, and commissioning specifications.

3.6 SYSTEMS OPERATIONS TRAINING

A. Commissioning Coordinator shall provide systems operations training in accordance with the requirements of the California Energy Code, HVAC and Plumbing specifications, and Division 01 specifications, including Section 017900, Demonstration and Training, and commissioning specifications.

3.7 COMMISSIONING REPORT

A. Commissioning Coordinator shall complete Commissioning Report in accordance with the requirements of the California Energy Code and Division 01 commissioning specifications.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fans.
 - 2. Air inlets and outlets.
 - 3. Filters.
 - 4. Dampers.
 - 5. Ductwork.
 - 6. Hydronic Piping.
 - 7. Valves.
 - 8. Valve boxes.
 - 9. Insulation.
 - 10. Thermal hanger shield inserts.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 23 00 50, Basic HVAC Materials and Methods.
- C. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
- D. Section 23 09 23, Direct Digital Control (DDC) System for HVAC.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
- C. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.4 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Record of pre-installation meeting.
- C. HCAIHCAIHCAIHCAI
- D. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

- B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.
- C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.
 - 2. Provide one complete set(s) of filters for each filter bank.

1.7 COORDINATED LAYOUT

- A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.
- B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.
 - 1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
 - 2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

B.O.D. = 9'-0" OFFSET UP 6" B.O.D. = 9'-6"

- 3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.
- C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.
- D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.8 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
 - 2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
 - 3. All items of a given type shall be products of the same manufacturer.
 - 4. Scheduled equipment performance is minimum capacity required.
 - 5. Scheduled electrical capacity shall be considered as maximum available.

6. Scheduled gas BTU input shall be considered as maximum available.

1.9 FIELD CONDITIONS

- A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of services.
 - 2. Do not interrupt services without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 FANS

- A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.
- B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.
- C. Provide variable speed switch for all direct drive fans.
- D. In-Line Centrifugal Fans:
 - 1. Centrifugal fan with airfoil blades, aluminum or steel housing, externally mounted belt-drive motor, external lube tubes, integral support brackets.
- E. Fan Drives:
 - 1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
 - 2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
 - 3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.
- F. Motors:
 - 1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
 - 2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
- G. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.
- H. Belts:
 - 1. All belts shall be furnished in matched sets.
 - 2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.

- I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
 - 4. American Coolair Corporation.
- J. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.3 AIR INLETS AND OUTLETS

- A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.
- C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.4 HCAIAIR FILTERS

- A. Provide MERV 13 disposable pleated media type. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:
 - 1. Standards:
 - a. ASHRAE Standard 52.2-2007.
 - b. Underwriters Laboratories: U.L. 900, Class 2.
 - 2. Construction:
 - a. Media: Synthetic or cotton-synthetic blend with radial pleats.
 - b. Media Frame: High wet-strength beverage board.
 - c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.
 - 3. Performance: 2" deep filter shall have a maximum initial air resistance of 0.31 inches w.g.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Camfil Farr, Inc., model 30/30.
 - 2. Flanders Corporation, model 40 LPD.
- C. Temporary (Construction Period) Filters:
 - 1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.
 - 2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.
- D. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.5 DAMPERS

- A. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.
 - 1. Rectangular Ductwork:
 - a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
 - b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
 - c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.
 - 2. Round Ductwork:
 - a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
 - b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.
 - 3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

2.6 DUCTWORK

- A. Construct and install sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.
 - 1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
 - 2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
 - 3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
 - 4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
 - 5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.
 - a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
 - b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.
- B. Design and installation standards:
 - 1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.

- 2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- 3. California Mechanical Code.
- C. Duct sizes indicated are external sizes.
- D. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
 - 1. Provide mill certification for galvanized material at request of the Project Inspector.
- E. Duct Sealants:
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 - 3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Design Polymerics, model DP1010.
 - 2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
 - 3) McGill Airseal, LLC.
- F. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.
- G. Rectangular Duct Fabrication:
 - 1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
 - a. SMACNA HVAC Duct Construction Standards
 - b. California Mechanical Code
 - 2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

238000 - HEATING, VENTILATING AND AIR CONDITIONING P246664.00 - UCDH CANCER CENTER RAD ONC LINAC REPLACEMENT

Table A				
Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC		
Through 12"	26	Not Required		
13" through 18"	24	Not Required		
19" through 30"	24	C/4		
31" through 42"	22	E/4		
43" through 54"	22	F/2		
55" through 60"	20	G/4		
61" through 84"	20	1/2		
85" through 96"	20	J/2		
Over 96"	18	K/2		

- 3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.
- 4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph "DAMPERS" for damper requirements.
- 5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
- H. Round and Oval Ductwork Fabrication:
 - 1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.
 - a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.
 - Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
 - 2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.
 - 2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.

3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

- 4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
- 5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

<u>Diameter</u>	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

- I. Duct Access Doors:
 - 1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.
 - 2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.
- J. Flexible Air Ducts:
 - 1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
 - 2) ThermaFlex model M KC.
 - 2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1.

Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.

- 3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
- 4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
- 5. Duct Access Panels:
 - a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:
 - 1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.
 - 2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.

2.7 HYDRONIC PIPING

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Mechanical Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.
- B. Chilled Water, Heating Hot Water, and Condenser Water Piping:
 - 1. Copper Tube and Fittings Aboveground:
 - a. Copper Tube and Fittings Aboveground: ASTM B88, Type L, drawn-temper, 150 psig minimum working pressure at 200 deg. F. Provide wrought-copper fittings and unions, ASTM B16.22, with full solder cup. Capped outlets shall be Schedule 40 screwed brass.
 - 2. Steel Pipe and Fittings Aboveground:
 - a. 2 inches and smaller: ASTM A 53/A 53M, Schedule 40 black steel with plain ends, 150 psig minimum working pressure at 200 deg. F. Provide malleable-iron threaded fittings, ASTM B16.3, Class 150, and unions, ASTM B16.39, Class 150, and cast-iron flanges and flange fittings, and threaded joints.
 - b. 2-1/2 inches and larger: ASTM A 53/A 53M, Schedule 40 black steel with plain ends, 150 psig minimum working pressure at 200 deg. F. Provide wrought-steel fittings, ASTM A 234/A 234M, and wrought-cast or forged-steel flanges and flange fittings, ASME B16.5, material group 1.1, with butt welding end connections and raised face.
 - 3. Underground Hydronic Piping:
 - a. Refer to Section 232113.13, Underground Hydronic Piping.

2.8 PIPE JOINING MATERIALS

- A. Refer to Division 22 and 23 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 (3.2-mm) 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 C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
 - 3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.

- C. Brazing Filler Metals:
 - 1. General Duty: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
- D. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.9 VALVES

- A. Gate Valves:
 - 1. 2-1/2 inches and smaller: Class150, bronze body, union bonnet, rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Hammond IB641, IB648, Nibco T-134, S-134, Milwaukee 1151, 1169, or equal.
 - 3 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, non-rising stem, solid wedge, flanged ends, conforming to MSS SP-70. Hammond IR-1138, Nibco F619, Milwaukee F2882A, Stockham G-612, or equal.
 - a. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

B. Ball Valves:

- 1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
- 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.
- C. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, or equal.
- D. Butterfly Valves:
 - 1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
 - 2. Provide valves with the following:
 - a. Seats: Suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
 - b. Bodies: Ductile iron or cast iron.
 - c. Discs: Bronze or stainless steel.
 - d. Stems or Shafts: Stainless steel.
 - e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 2 through 12 inches: Milwaukee Valve, CL series, Nibco, Inc., model LD2000-3, or equal.
- E. Silent Check Valves (for use on pump discharge):
 - 1. General: Provide spring loaded check valves at pump discharge of all pumps.
 - a. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.
 - b. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrinding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.

2.10 INSULATION MATERIALS

- A. General:
 - 1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
 - 2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
 - 3. 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.
 - 4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
 - 5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
 - 6. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
 - 7. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
- B. Insulation Materials:
 - 1. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Johns Manville; a Berkshire Hathaway company.
 - 2) Knauf Insulation.
 - 3) Manson Insulation Inc.
 - 4) Owens Corning.
 - b. 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.
 - 2. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Provide 2-inch wide stapling and taping flange.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) CertainTeed Corporation.
 - 2) Johns Manville.
 - 3) Knauf Insulation.
 - 4) Owens Corning.
- C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.

- 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
- 3. Service Temperature Range: Minus 50 to plus 220 deg F.
- 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.

2.11 THERMAL HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. Buckaroos, Inc.
 - 2. Carpenter & Paterson, Inc.
 - 3. Clement Support Services.
 - 4. Rilco Manufacturing Co., Inc.
- B. Flame-spread index of 25 or less and smoke-developed index of 50 or less as tested by ASTM E 84.
- C. Insulation-Insert Material for Cold or Hot Piping, from Minus 40 to Plus 275 Deg F: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength or ASTM C 1126, Type III rigid phenolic foam and vapor barrier.
 - 1. Phenolic:
 - a. NPS 10 and Smaller: 3.75-lb/cu. Ft. minimum compressive strength.
 - b. NPS 12 to NPS 30: 5.0-lb/cu. ft. minimum compressive strength.
- D. Insulation-Insert Material for Piping Above 275 Deg F: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- E. Insulation Protection Shields: Galvanized metal, G90 coating designation, complying with ASTM A 653/A 653M, 180-degree saddle.
- F. Heavy Duty Insulation Protection Shields: Galvanized metal, 12-gage, G90 coating designation, complying with ASTM A 653/A 653M, 180-degree saddle. Structural steel plate welded to bottom of galvanized shield for sizes NPS 6 and larger.
- G. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- H. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- I. Insert Length: Extend minimum 1-1/2 inches beyond sheet metal shield.

2.12 TEMPERATURE CONTROL SYSTEM

- A. Wiring and Conduit:
 - 1. Wiring shall conform to National Electric Code. All wiring shall be in rigid steel conduit. Refer to Division 26 for conduit requirements.
- 2. All conduit and wiring associated with the temperature control system, regardless of voltage, is included as part of this Section. Contractor shall obtain power for temperature control devices from the nearest available adequate source. Furnish all interlocks, power supplies, relays, and the like required to render the control system complete and functional for the intended use.
- B. Thermostats:
 - 1. Refer to Drawings for thermostat model. Provide item scheduled on Drawings, or equal.
 - 2. Provide thermostats where indicated on drawings. Provide all relays, transformers and the like to render the control system complete and fully operable.
 - 3. Unless otherwise noted, provide thermostats located in conditioned spaces with blank front locking covers. Thermostats shall be Underwriters Laboratories listed under UL934 for use in air plenum applications. Submit all thermostat locations for review before installation.
 - a. Room thermostats shall be capable of being replaced without the need for controller recalibration.
 - b. Room thermostats shall have manufactured space temperature and setpoint signal precision tolerances of no greater than 1 degree F.
 - c. Unless otherwise indicated, each room thermostat or sensor shall be provided with a momentary pushbutton for override of unoccupied operation.

PART 3 - EXECUTION

3.1 FAN INSTALLATION

- A. Provide access doors for fans or motors mounted in ductwork.
- B. Mount all fans as detailed on Drawings and in compliance with CBC standards.
- C. Fan motors mounted in air-stream to be totally enclosed.
- D. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.

3.2 AIR INLETS AND OUTLETS INSTALLATION

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
- B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.
- C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
 - 3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.

- D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.
- E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.3 FILTER HOUSING INSTALLATION

- A. Mount filters in airtight galvanized steel housings furnished by the filter manufacturer, or shop fabricated. Housings shall incorporate integral tracks to accommodate filters, and flanges for connection to duct or casing system.
 - 1. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.
 - 2. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking latch handle devices.
- B. Air filters shall be accessible for cleaning or replacement.
- C. Identify each filter access door with 1/2 inch high minimum stenciled letters.

3.4 TEMPORARY FILTERS

- A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.
 - 1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.5 DUCTWORK INSTALLATION

- A. General:
 - 1. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.
 - 2. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealers shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.
 - 3. Where ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
 - 4. Horizontal runs of ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
 - 5. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.
 - 6. Paint inside of ducts, visible through grille, dull black.
 - 7. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.
 - 8. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.
- B. Firestopping:

- 1. Pack the annular space between duct openings and ducts penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
- 2. Firestopping systems to be installed in strict accordance with manufacturer's instructions.
- 3. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.
- C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger	
For ducts with P/2=72"	320 pounds per hanger	
For ducts with P/2=96"	460 pounds per hanger	
For duct with P/2 larger than 120"	NOT ALLOWED	

- E. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.
- G. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.
 - 1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
 - 2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.
- H. Installation of Flexible Ductwork:
 - 1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.
 - a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
 - b. Flexible duct bends shall be not less than 1-1/2 duct diameter bend radius.

- 2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
- 3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.6 DUCTWORK SEALING AND LEAK TESTING

- A. All ductwork shall receive a Class A seal.
- B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

C. Leakage Classes:

Pressure Class	Leakage Class		
	Round Duct	Rectangular Duct	
2"W.G. or less	8	16	
4"W.G. or greater	2	4	

D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 230800.13, "Title 24 Commissioning of HVAC."

3.7 PIPING INSTALLATION

A. General:

- 1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
- 2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
- 3. Install piping to permit application of insulation and to allow valve servicing.
- 4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
- 5. Horizontal runs of pipes and conduits suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
- 6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
- 7. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
- 8. Verify final equipment and fixture locations for roughing-in.
- 9. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.
- 10. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
- 11. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
- 12. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
- 13. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
- B. Sleeves:

- 1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and sleeve and slab or wall shall be sealed watertight.
- 2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.
- C. Floor, Wall, and Ceiling Plates:
 - 1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.
- D. Firestopping:
 - 1. Pack the annular space between pipe sleeves and pipes penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
 - Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with CBC requirements.
 - 3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
 - 4. Copper and steel piping shall have SpecSeal, or equal, plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
 - 5. Firestopping systems to be installed in strict accordance with manufacturer's instructions.
 - 6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

3.8 PIPE JOINTS AND CONNECTIONS

- A. General:
 - 1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
 - 3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.
- B. Threaded Pipe: 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 thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for type of water conveyed by pipe. Join flanges with gasket and bolts according to ASME B31.9.
- D. Copper Pipe and Tubing: All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except pneumatic control piping, and hydronic piping having grooved-end fittings and couplings.
- E. Welded Pipe:
 - 1. Make up with oxyacetylene or electric arc process.

- 2. All welding shall conform to the American Standard Code for Power Piping ASME B-31.1. When requested by the Architect, furnish certification from an approved testing agency or National Certified Pipe Welding Bureau that the welders performing the work are qualified.
- 3. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.
- 4. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.
- F. Flexible Connections:
 - 1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, except fan coil units under 2000 cfm, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
 - 2. Anchor piping securely on the system side of each flexible connection.

3.9 VALVE INSTALLATION

- A. General:
 - 1. Valves shall be full line size unless indicated otherwise on Drawings.
 - 2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
 - 3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
 - 4. Locate valves for easy access and provide separate support where necessary.
 - 5. Install valves in position to allow full stem movement.
 - 6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
 - 7. Butterfly valves conforming to the paragraph "Butterfly Valves" may be used in lieu of gate or globe valves for locations above grade.
 - 8. Ball valves conforming to the paragraph "Ball Valves" may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
 - 9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
 - 10. Provide gate or globe valves on inlet and outlet of each pump.
- B. Gate Valves:
 - 1. Furnish valves in copper lines with adapters to suit valve / line requirements.
 - 2. Underground gate valves:
 - a. Underground valves 3 inches and smaller may be furnished with operating nuts or handwheels, and with Ring-Tite joint ends.
 - b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- C. Swing Check Valves: Install in horizontal position with hinge pin level.
- D. Butterfly Valves: Install with stems horizontal.
- E. Silent Check Valves: Install in horizontal or vertical position between flanges.
- F. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.10 HANGER AND SUPPORT INSTALLATION

A. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Where building structural members do not match piping and ductwork support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.

- 1. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - a. Provide copper-plated or felt-lined hangers for use on uninsulated copper tubing.
- 2. Materials and design for ductwork support shall be per SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
- B. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
- C. Riser clamps: B-line model B3373, or equal.
- D. Rubber Neoprene Pipe Isolators:
 - 1. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
 - 2. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 - 3. Manufacturers:
 - a. Vertical runs: Acousto-Plumb or equal.
 - b. Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
- E. Pipe Hanger and Support Placement and Spacing:
 - 1. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
 - 2. Vertical piping hanger and support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

<u>Pipe</u> <u>Diameter</u>	<u>Steel</u> <u>Threaded or</u> <u>Welded</u> (Note 3)	<u>Copper</u> <u>Brazed or</u> <u>Soldered</u> (Notes 3, 4)	<u>CPVC & PVC (Note</u> <u>2)</u>
1/2 - 1"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- a. Note 1: Provide mid-story guides.
- b. Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- c. Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- d. Note 4: Includes refrigerant piping, including vapor and hot gas pipes.

3. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

<u>Pipe</u> <u>Diameter</u>	Steel Threaded or Welded (Note 2)	Copper Brazed or Soldered (Notes 2, 3)	<u>CPVC & PVC (Note</u> <u>1)</u>
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

- a. Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- b. Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- c. Note 3: Includes refrigerant piping, including vapor and hot gas pipes.
- 4. Suspended Piping:
 - a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter	
2" and Smaller	3/8"	
2-1/2" to 3-1/2"	1/2"	
4" to 5"	5/8"	
6"	3/4"	

- b. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.
- c. Trapeze Suspension: B-Line, or equal, 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.
- d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
- e. Pipe Clamps and Straps: B-Line B2000, B2400, or equal. Where used for seismic support systems, provide B-Line B2400 series, or equal, pipe straps.
- f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
- g. Steel Connectors: Beam clamps with retainers.
- 5. Insulated Piping:
 - a. Do not interrupt insulation at pipe hangers and clamps.
 - b. Use thermal hanger shield inserts or MSS protection saddles and shields.
 - c. Thermal Hanger Shield Inserts:
 - 1) Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 3) For below ambient services, maintain continuous vapor barrier.
 - 4) For Clevis or Band Hangers: Install thermal-hanger shield inserts with insulation protection shields.

- 5) For Trapeze or Clamped Systems: Install thermal-hanger shield inserts with heavyduty insulation protection shields. Install additional 180-degree galvanized shield for top of support if clamping is required.
- d. MSS Protection Saddles and Shields:
 - 1) MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 2) MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 3) Shield Dimensions for Pipe: Of length recommended in writing by manufacturer to prevent crushing insulation. 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.
 - e) NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

F. Piping Support to Structure:

- 1. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
- G. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
- H. Duct Support to Structure:
 - 1. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw	
For ducts with P/2=72"	1/4"x 1-1/2" lag screw	
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw	

2. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger	
For ducts with P/2=72"	320 pounds per hanger	
For ducts with P/2=96"	460 pounds per hanger	
For duct with P/2 larger than 120"	NOT ALLOWED	

- 3. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- 4. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

3.11 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

- 1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.
- 2. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
- 3. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.
- 4. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
- 5. 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.
- 6. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- 7. Install multiple layers of insulation with longitudinal and end seams staggered.
- 8. Keep insulation materials dry during application and finishing.
- 9. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- 10. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- 11. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- 12. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- 13. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.
- 14. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. 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.
 - c. 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.
 - d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- B. Piping Insulation Installation:
 - 1. General:
 - a. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
 - b. Provide removable insulation covers for items requiring periodic service or inspection.
 - c. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation.
 - d. Provide pre-formed PVC valve and fitting covers for indoor piping.
 - e. Provide factory-fabricated aluminum valve and fitting covers for outdoor piping.
 - f. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
 - 2. Below-Ambient Services Including Chilled Water Supply and Return and Refrigerant Piping:
 - a. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of woven glass fiber cloth saturated in Foster Sealfas 30-36, 3M, or equal, extending 3 inches over the adjoining pipe insulation. Finish with a coat of Foster Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.
 - b. Variable refrigerant flow (VRF) heat pump systems: Insulation for VRF system refrigerant piping shall be installed according to VRF unit manufacturer's instructions.

- C. Duct Insulation Installation:
 - 1. General:
 - a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.
 - b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.
 - c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.
 - 2. Mineral Fiber Blanket Installation:
 - a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

3.12 TEMPERATURE CONTROL SYSTEM INSTALLATION

A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.13 EQUIPMENT START-UP

- A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.
- B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.
- C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.
- D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.
- E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.14 TESTING AND BALANCING

A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.15 CLEANING AND PROTECTION

A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

- B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.
- D. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.16 EQUIPMENT MOUNTING

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.17 INDOOR PIPING INSULATION SCHEDULE

- A. Hydronic Piping:
 - 1. Chilled Water Piping:
 - a. Piping smaller than 1-1/2 inches diameter:
 - 1) Mineral-Fiber, Preformed Pipe: 1/2 inch thick.
 - b. Piping 1-1/2 inches diameter and larger:
 - 1) Mineral-Fiber, Preformed Pipe: 1 inch thick.

3.18 INDOOR FIELD-APPLIED PIPING JACKET SCHEDULE

- A. Piping, concealed: None.
- B. Piping, exposed: PVC, 20 mils thick.

3.19 INDOOR DUCT INSULATION SCHEDULE

- A. Ducts Located Within Building Thermal Envelope:
 - 1. Minimum R-Value = R-4.2.
 - 2. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.
- B. Ducts Located Within Building Outside Thermal Envelope:
 - 1. Minimum R-Value R-8.0.
 - 2. Supply and Return Ducts: Mineral Fiber Blanket, 3 inches thick, 0.75 lb/cu. ft.

3.20 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

A. Insulated ducts in concealed spaces: None.

END OF SECTION

SECTION 260500 ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install all necessary labor, materials, tools, and equipment to perform and completely finish the work according to the intent of this specification, and the accompanying drawings.
- B. Provide conduit, wires and other miscellaneous materials, equipment, and devices, not specifically mentioned in other sections of Division 26, but necessary and/or required for equipment or system operation of function.
- C. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service. Refer to Section 260519 of these specifications for connection requirements.
- D. Drawings indicate design loads and voltages and corresponding control equipment, feeders, and overcurrent devices. If equipment actually furnished, other than for equipment provided by the University, have loads or voltages 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 University. Such adjustment shall be subject to the review of the University's Representative.

1.2 LOCAL CONDITIONS

- A. Examine site; verify dimensions and locations against drawings and become informed of all conditions under which work is to be done before submitting proposal. No allowance will be made for extra expenses because of omission on Contractor's part to include cost of work under prevailing conditions.
- B. Information shown relative to services is based upon available records and data shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made without extra cost.
- C. Extreme care shall be exercised in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations.
- D. Request any utility shutdown, dig permit or road closure through the University's Representative, 14 days in advance. Include detailed procedure and proposed schedule. In each case approval must be obtained from the University's Representative for the requested shutdown time and work involved. Shutdown work shall be performed on overtime hours if so, directed by the University.
- E. Protect premise and work of other trades from damage arising out of installation of work of this division. If damage has occurred, repair or replace materials and parts of premises as directed by University's Representative at no cost to the University.

1.3 CODES AND STANDARDS

- A. Applicable codes are those specified in Section 01 41 00 Regulatory Requirements. Nothing in the Drawings or Specifications shall be construed to permit work not conforming to these codes, latest edition as adopted by authority having jurisdiction.
- B. Material Standards: All material shall be new and shall conform to the standards where such have been established for the particular material in question. Publications and Standards of the organization listed are applicable to materials specified herein. Also refer to Division of these specifications: Insulated Cable Engineers Association (ICEA), Institute of Electrical and Electronic Engineers (IEEE), Edison Electric Institute (EEI), American Wood Preservers Association (AWPA), National Board of Fire Underwriters (NBFU), Illuminating Engineering Society (IES), Electrical Testing Laboratory (ETL).
- C. Code compliance is mandatory no information or details on the drawings or specifications permits work not conforming to code. Where work is shown to exceed minimum code, requirements perform work per drawings and specifications.

1.4 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. Coordinate installation of recessed electrical equipment with concealed ductwork and piping, and wall thickness.
- B. Do not scale drawings. Obtain dimensions for layout of equipment from Architectural plans and details unless indicated on Electrical plans. Field measurements take precedence over dimensioned drawings.
- C. Bring all discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions to the immediate attention of the University's Representative.
- 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 with Engineer. Equipment which exceeds specified maximum dimensions or which reduces required clearances shall not be accepted.

1.5 RECORD DRAWINGS

A. Upon completion of all Work, but before final acceptance, the Contractor shall furnish the University's Representative with complete sets of reproducible drawings updated and corrected to "as-built" conditions as specified. The contract documents drawings issued for bid shall be revised for "as-built" conditions. Include electronic panelboard files in Excel format updated to "as-built" conditions, copies of all submittal data, shop drawings, control Panel layout, point to point wiring diagram, conduit routing, underground duct banks, site lighting and any other detailed drawings.

- B. All symbols, designations, and layers used in preparing Record Drawing shall match those used in Contract Drawings and electronic files.
- C. Show all buried and concealed conduit, stub-outs, etc. Locate all buried conduit and stub-outs by dimensions from permanent, easily located, and identifiable portions of structure; also, dimension ends of stub-outs, etc. Note depth of buried items below grade.

1.6 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Submit for review by the University's Representative data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable. Provide complete electrical characteristics for all equipment. Submittals for lighting fixtures shall include Photometric data.
 - 2. Refer to the individual sections for identified equipment and materials for which submittals are required.
 - 3. Refer to Division 1 for required procedures.
- B. Operation and Maintenance Data and Instruction:
 - 1. Refer to Division 1 for detail requirements.
 - 2. Printed Material: Provide required printed material for binding in operation and maintenance manuals.
 - 3. Instructions of University Personnel:
 - a. Before final inspection, as designated by the University's Representative provide a competent representative to instruct University's designated personnel in systems under this division of the specifications. For equipment requiring seasonal operation, perform instructions for other season within six months unless requested otherwise.
 - 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.
 - c. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. Materials mentioned herein or on drawings require that each item listed be provided and of quality noted, or an approved equal. All material shall be new, full weight and standard in all respects and in first-class conditions. Materials and equipment shall be uniform throughout the installation. Where possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.

- B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein. Substitutions will also be evaluated on maintenance track record and parts availability for previous installations that have been installed a minimum of five years. Refer to Specification Section 01 33 00. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of Engineer.
- C. All electrical equipment and materials shall satisfy minimum requirements of NEMA, IEEE and ANSI standards. All materials must be UL approved, or if not covered by UL testing standards, shall be test and approved by a Nationally Recognized Testing Laboratory (NRTL).
- D. Work such as painting, patching, welding, or carpentry related to the work of this Division shall be performed by the appropriate trade experienced in that work but shall be provided for under this Division.

PART 3 EXECUTION

3.1 GENERAL

- A. All electricians to be state certified and apprentices in an approved training program.
- B. When changes in location of any work are required, obtain approval of University's Representative before making changes.
- C. Make changes at no extra cost.
- D. Do not change indicated sizes without written approval of University's Representative.
- E. Provide all necessary offsets and crossovers in conduits, raceways, cable trays and ducts.
- F. Provide flexible connections of short length to installations or equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor across all flexible connections.
- G. Install exposed conduits parallel to walls and ceilings and vertically plumb, unless otherwise indicated.
- H. Existing equipment or electrical wiring, which is to remain, but has been removed to facilitate the installation of the new equipment, shall be restored to its original operating condition.
- I. Where electrical items penetrate fire or smoke rated walls, ceilings, and floors, comply with Section Division 7.
- J. Before any cutting, burning, heating or other work that will emit smoke, dust or other products of combustion that may set off the fire alarm system, request a fire alarm system shutdown from the University's inspector. This request shall be made at least 14 days prior to the date the shutdown is required. If this requirement is ignored and triggers the fire alarm system, the offending party shall be responsible for all false alarm charges from the fire department. Instruct all personnel of this requirement before they

are permitted on the job site. If the job site has a portable fire alarm system installed for the construction period, turn the system on and off each working day.

3.2 QUALITY ASSURANCE AND PROJECT SAFETY

A. Provide quality assurance and project safety programs. Satisfy the minimum acceptable requirements provided in the specifications.

3.3 PREPARATION

- A. Examine Drawings and Site; be familiar with types of construction where electrical installation is involved.
 - 1. Work shall be neatly installed in a professional manner in accordance with NECA Standard of Installation. Work shall be coordinated with other trades to avoid conflicts. Clarifications will be made by University's Representative and minor adjustments shall be made without additional cost to University. Obtain clarification from University's Representative concerning any obvious discrepancies or omissions in work before bidding. All work involved in correcting obvious errors or omissions after award of Contract shall be performed as directed by University's Representative without additional cost to University.
- B. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial) but shall be followed as closely as possible. Drawings and Specifications are for assistance and guidance, and exact locations, distances, levels, etc., will be governed by Site.
- C. Schedule of Values:
 - 1. Refer to Division 1 for submittal requirements.
 - 2. Provide a schedule of values for the electrical work specified under Division 26. Include separate labor and material itemization for each line item requested. The itemized schedule of values will be used to determine project completion and progress for payment requests, including overhead and profit for each itemization. Schedule of values must be submitted and approved prior to first pay request. Provide the following line items as a minimum level of itemization:
 - a. Electrical service and distribution (include all power equipment, i.e., panelboards, transformers, feeders, motor controllers, etc.).
 - b. Lighting systems (include all fixtures, lamps, branch circuiting, and lighting controls).
 - c. Devices (include all power outlets and branch circuit wiring not associated with lighting, motors, or equipment connections).
 - d. Equipment connections (include all wiring and connection to HVAC, elevators, etc., including controlling devices and feeders).
 - e. Basic work and materials (include work common to all systems, i.e., backboards, cutting and patching, demolition, temporary services, record drawings, permits, etc.).
 - f. Special systems (itemize separately, including emergency power supply system, grounding system, UPS equipment, etc.).
 - g. Communications/signaling systems (include all low voltage systems, itemized separately, i.e., fire alarm, sound paging,

security, etc.).

3.4 WORKING SPACE

- A. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders. In general, provide 36" minimum clear workspace in front of panelboards and controls.
 - 1. 36" @ 250V and less.
 - 2. 42" @ 250V to 600V.

3.5 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material including University furnished material. Handle materials in accordance with manufacturer's applicable standards and supplier's recommendations, and in a manner to prevent damage to materials. Store packed materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises and replaced at no additional cost to the University.
- B. All material, except items specifically designed to be installed outdoors, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided. Provide temperature and humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weathertight structure. Equipment stored other than as specified above shall be removed from the premises and replaced at no additional cost to the University.
- C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged, or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced at no additional cost to the University.

3.6 CARE AND CLEANING

- A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trim, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.
- B. Accessible elements of disconnecting and protective devices of equipment, coils of dry type transformers and the like shall be cleaned with compressed air (less than 15 PSI) and the enclosures vacuum cleaned prior to being energized.
- C. Clean light fixtures and lamps thoroughly, just prior to final inspection. Fixture enclosures, shielding, etc., shall be cleaned by an approved method.

- D. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinets unless required by the University's Representative. Remove trim covers before painting. Under no conditions shall locks or exposed trim clamps be painted.
- E. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.
- F. All broken, damaged, or otherwise defective parts shall be repaired or replaced without additional cost to the University. Work shall be left in a condition satisfactory to University's Representative. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work. Systems and equipment shall be left in a satisfactory operating condition.
- G. All surplus materials and debris resulting from this work shall be periodically cleaned out and removed from site; this includes surplus excavated material.

3.7 CUTTING AND PATCHING

- A. Provide necessary cutting and patching required to accomplish the work of Division 26.
- B. Do not endanger the stability of the structure by cutting, drilling, or otherwise modifying the structural members of the building. Direct all requests for structural modifications to the University's Representative for approval. Proceed with these modifications only as directed by the University's Representative.
- C. Cutting and patching requirements will be modified only if General Construction Specifications and drawings specifically state that certain portions or all cutting and patching required for each of the various trades is to be performed.
- D. Refer to General Construction Specifications for execution and requirements for patching and painting and comply with applicable provisions as to materials and quality of installation.

3.8 PROTECTION

A. In performance of work, protect work from damage. Protect electrical equipment, stored, and installed, from dust, water, or other damage.

3.9 EQUIPMENT IDENTIFICATION

A. Panelboards, remote control switches, terminal boxes, etc., shall be properly identified according to section 260553 of these specifications.

3.10 RUST INHIBITER

A. Channels, joiners, hangers, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating freshly deposited

zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of one hundred twenty (120) hours when subjected to a standard salt spray cabinet test, or shall be hot dipped galvanized.

3.11 ELECTRICAL SYSTEMS OPERATIONAL TESTS, MANUFACTURERS SYSTEMS CERTIFICATION AND DESIGN AUTHORITY ASSISTANCE

- A. Testing:
 - 1. Provide tests specified in other sections. Test all wiring and connections for continuity and grounds; where such test indicates faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.
 - 2. Prior to the final inspection, the systems or equipment shall be tested and reported as therein specified. Five (5) typewritten copies of the tests shall be submitted to the University's Representative for approval. Testing does not replace the requirement for final inspection of the project work.
 - 3. All electrical systems shall be tested for compliance with the specifications.
- B. Manufacturers Certifications:
 - 1. The electrical systems specified herein shall be reviewed for compliance with theses specifications, installation in accordance with the manufacturers' recommendations and system operation by a representative of the manufacturer. The manufacturer shall submit certification that the system has been reviewed by the manufacturer, is installed in accordance with the manufacturer's recommendations and is operating in accordance with the specifications.
 - 2. Provide manufacturers certification for the following systems:
 - a. Fire Alarm System
 - b. Clock System
 - c. Security Systems
 - d. Intercom System
 - e. Public Address System
 - f. Lighting Control Systems
 - g. Automatic transfer switches
 - 3. Design Authority Assistance:
 - a. Remove equipment covers (i.e., panelboard trims, motor controls, device plates, and junction box covers) as directed for inspection of internal wiring. Accessible ceilings shall be removed as directed for inspection of equipment installed above ceilings.
 - b. Energize and de-energize circuits and equipment as directed. Demonstrate operation of equipment and systems as directed by the University's Representative.
 - c. Provide authorized representatives of the manufacturers to demonstrate to the University's Representative compliance with the specifications of their respective system during or prior to the final inspection at a time designated by the University's Representative. Refer to the specific specification section for additional testing requirements. Representatives of the following systems are required for demonstrations:

- 1) Fire Alarm System
- 2) Intercom System
- 3) Surveillance System
- 4) Public Address System
- 5) Lighting Control System
- 6) Automatic Transfer Switches

3.12 CLOSING OF AN UNINSPECTED WORK

- A. Do not allow or cause any of work installed hereunder to be covered up or enclosed before it has been inspected and approved.
- B. Should any work be enclosed or covered up before it has been approved, uncover such work and after it has been inspected and approved, make all repairs necessary to restore work of others to conditions in which it was found at time of cutting, all without additional cost to the University.
- 3.13 NOISE AND VIBRATION
 - A. Cooperate in reducing objectionable noise or vibration. If noise or vibration occurs as a result of the use of improper material or installation, correct these conditions at no cost to the University.

END OF SECTION

SECTION 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes building wire and SO cable with insulation rated 600 volts and less; and wiring connectors and connections.
- B. Related Sections:
 - 1. Section 26 05 53 Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. ANSI/NETA ATS 2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- B. NECA (National Electrical Contractors Association) Standard of Installation.
- C. ANSI/NFPA 70 National Electrical Code (NEC).
- D. Part 3, Title 24, California Electrical Code (CEC).
- E. Underwriters Laboratories, Inc. (UL).
 - 1. UL-83, UL-44 Thermoplastic-Insulated Wire and Cables.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Stranded conductor for all feeders and branch circuits.
 - 2. Stranded conductors for control circuits.
 - 3. Conductor not smaller than 12 AWG for power and lighting circuits. The minimum size of emergency system conductors shall be 10 AWG.
 - 4. Conductor not smaller than 16 AWG for control circuits.
 - 5. 10 AWG conductors for 20 amperes, 120-volt branch circuit home runs longer than 75 feet.
 - 6. 10 AWG conductors for 20 amperes, 277-volt branch circuit home runs longer than 200 feet.
 - 7. Cables shall be jacketed 600 volts SO type.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
 - 2. Exposed Dry Interior Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
 - 3. Exterior Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
 - 4. Underground Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
 - 5. Cord Drops: Use 600 volt 'SO' cable was indicated on drawings.
- 1.4 SUBMITTALS

A. Product Data: Submit for building wire and each cable type.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.8 COORDINATION

- A. Where wire and cable destination are indicated and routing is not shown, determine routing and lengths required.
- B. Determine required separation between wire, cable, and other work. Determine cable routing to avoid interference with other work.
- C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. Diamond Wire & Cable Co.
 - 2. Essex Group Inc.
 - 3. General Cable Co.
 - 4. Approved equal.
- B. Product Description: Single conductor 600 volt insulated wire.
- C. Conductor: Copper.

2.2 ELECTRICAL INSULATING TAPE:

- A. Electrical insulating tape shall be 600-volt, flame retardant, cold and weather resistant, minimally .85 mil thick plastic vinyl material: Scotch No. 88, Tomic No. 85, Permacel No. 295, or equal.
- 2.3 INSULATING RESIN:
 - A. Use two-part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Scotchcast 3570G or equivalent.
- 2.4 REDUCING ADAPTERS:

A. Burndy, Thomas, and Betts or approved equal.

2.5 WIRING CONNECTORS

- A. Bolted pressure connectors: Cast bronze compression bolts designed for parallel taps, tees, crosses, or end-to-end connections.
- B. Insulated spring wire connectors (No. 10 AWG and smaller): multi-part construction incorporating a steel spring enclosed with a color coded outer thermoplastic shell.
- C. Insulated spring wire wet/damp location spring wire connectors: multi-part construction incorporating a steel spring enclosed with a color coded outer thermoplastic shell pre-filled with silicone base to protect against moisture and corrosion.
- D. Splices, taps and connectors (No. 8 AWG and larger): Burndy, T & B, or equal Tin-plated copper highcompression type lugs for installation with hand or hydraulically operated crimping tools and dies. Provide 2-hole lugs for size #4/0 AWG and larger wire were terminated to bus bars.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify interior of building has been protected from weather.
- B. Verify mechanical work likely to damage wire and cable has been completed.
- C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

- A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
- B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- D. Extend existing circuits using materials and methods as specified.
- E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

- C. Splices in homerun conductors to panelboards, switchboards, switchgear, motor control centers, motor control enclosures, and other panels shall be kept to the minimum practicable and shall only be made as necessary to support pulling of the conductors. Make splices in conductors only within junction boxes, wiring troughs and other enclosures as permitted by the California Electrical Code.
- D. Do not splice conductors in pull boxes, panelboards, switchboards, switchgear, motor control centers or motor control enclosures.
- E. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- F. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
 - 3. A maximum of three branch circuits are to be installed on any one conduit on 3 phase 4 wire system.
 - 4. Install a minimum of twelve inches of slack conductor at each outlet.
- G. Special Techniques SO Cable:
 - 1. Cable connectors shall be steel case liquid tight sized for the cable diameter and shall use strain relief gland fitting to prevent tension on conductor terminals.
- H. Special Techniques Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Tape uninsulated conductors and connectors with electrical tape equal to the insulation of wire and with all irregular surfaces properly padded with "Scotchfil," 2nd product or equal putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1 or equal.
 - 4. Install solderless tool applied pressure connectors and lugs for copper conductor splices and taps, 8 AWG and larger.
 - 5. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - 6. Splices in conductors installed below grades are not permitted, unless approved in writing by the University's Representative.
 - 7. Outdoors or below grade, use wire connectors or compression type with heat shrink style watertight splice covers. Use Scotchcast 3570G resin epoxy to waterproof connections.
 - 8. Install waterproof wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller in outdoor or wet locations.
 - 9. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.
 - 10. Secure conductors to circuit breakers, lugs and ground/neutral bus terminations utilizing a torque screwdriver or wrench to the manufacturer's specified torque values.

3.5 WIRE COLOR

- A. General
 - 1. Color code all conductors. Wire sizes #6 AWG and smaller shall have integral color-coded insulation. Wire sizes #4 AWG and larger may have black insulation but identified by color coded tape at all junctions, splice, pull or termination points. Tape shall be applied ½ lap to at least 6 inches of conductor. Color code wires as follows:

Conductors	120/208 Volts	277/480 Volts
Phase A	Black	Brown
Phase B	Red	Violet
Phase C	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

- B. Branch Circuits: Shared neutral conductors for multiple circuits are not permitted. Provide a separate neutral conductor for each phase conductor.
- C. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- D. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- E. Feeder Circuit Conductors: Uniquely color code each phase.
- 3.6 CONTROL, COMMUNICATION AND SIGNAL CONDUCTORS
 - A. Install in separate raceway systems from electrical line voltage wiring.
- 3.7 FIELD QUALITY CONTROL
 - A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.3.2.A.
 - B. Subject cables sized #2 AWG and larger, rated 600 volts AC to insulation resistance test per NETA ATS 7.3.2 B.2. Make tests and record insulation resistance with circuits isolated from source and load.
 - C. Do not megger any cables after connecting to any equipment, unless specifically directed to do so by Architect.
 - D. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Architect.

END OF SECTION

SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Active electrodes.
 - 2. Wire.
 - 3. Mechanical connectors.
 - 4. Exothermic connections.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.
- B. International Electrical Testing Association:
 - 1. ANSI/NETA ATS 2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- C. Part 3, Title 24, California Electrical Code (CEC).
- D. NFPA 99 Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

- A. Existing grounding systems use the following elements as grounding electrodes:
 - 1. Existing Metal underground water pipe.
 - 2. Metal building frame.
 - 3. Concrete-encased electrode.
 - 4. Rod electrode.
 - 5. Plate electrode.

1.4 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms maximum.
- 1.6 SUBMITTALS
 - A. Product Data: Submit data on grounding electrodes and connections.

- B. Test Reports: Indicate overall resistance to ground.
- C. Test Reports: Indicate resistance between ground electrodes of different panels serving patient care areas.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Project Record Documents: Record actual locations of components and grounding electrodes.
- 1.8 QUALITY ASSURANCE
 - A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.
- 1.9 QUALIFICATIONS
 - A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- 1.10 DELIVERY, STORAGE, AND HANDLING
 - A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
 - B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
 - C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.
- 1.11 COORDINATION
 - A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

- 2.1 WIRE
 - A. Material: Stranded copper.
 - B. Grounding Electrode Conductor: Copper conductor insulated if in conduit or above grade exposed, bare if direct buried.
 - C. Bonding Conductor: Copper conductor insulated.
- 2.2 MECHANICAL CONNECTORS
 - A. Description: Bronze connectors, suitable for grounding and bonding applications,

in configurations required for particular installation.

2.3 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove paint, rust, mill oils and surface contaminants at connection points.

3.2 EXISTING WORK

- A. Modify existing grounding system to maintain continuity to accommodate renovations.
- B. Extend existing grounding system using materials and methods as specified.

3.3 INSTALLATION

- A. Install grounding and bonding conductors concealed from view.
- B. Bond together metal siding not attached to grounded structure, bond to ground.
- C. Install grounding and bonding in patient care areas to meet requirements of NFPA 99.
- D. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- E. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.
- F. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- G. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.
- H. Size grounding conductors in accordance with CEC or as indicated on drawings. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits as necessary by

means of grounding bushings on terminations at panelboards and switchboards to grounding bus.

I. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

- A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.13A.
- B. Perform electrical tests in accordance with NETA ATS, 7.13B.
- C. Perform ground resistance testing in accordance with IEEE 142.
- D. Perform continuity testing in accordance with IEEE 142.
- E. Perform grounding system test in patient care areas accordance with 2018 NFPA 99 6.3.3.1.
- F. Provide written test results of grounding system and submit to Architect.
- 3.5 INDEPENDENT TESTING ORGANIZATION AND PERSONNEL
 - A. Testing organization and personnel shall meet the requirements of NETA ATS 3.1 and 3.2.
 - B. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Architect.
 - C. Perform grounding system test in patient care areas accordance with 2018 NFPA 99 6.3.3.1.

END OF SECTION

SECTION 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit and cable tray supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.
 - 6. Firestopping relating to electrical work.
 - 7. Floor and wall mounted equipment base and support.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - 4. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems.
- B. Part 3, Title 24, California Electrical Code (CEC).]
- C. Underwriters Laboratories Inc.:
 - 1. UL 1479 Fire Tests of Through-Penetration Firestops.
 - 2. UL Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: UL 1479, to achieve fire ratings in accordance with UL Design Numbers noted on Drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Penetrations: Provide through-penetration firestop systems that are installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.

- 1. Install complete through penetration firestop systems that have been tested and are listed by recognized testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of site conditions.
- 2. F-Rated Systems: Install through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814 or UL 1479, but not less than the fire resistance rating of the assembly being penetrated.
- 3. T-Rated Systems: Install through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.
- B. Support systems shall be adequate for weight of equipment and raceways, including wiring which they carry.

1.6 SUBMITTALS

- A. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance, and limitation criteria.
- B. Design Data: Indicate load carrying capacity of hangers and supports.
- C. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 SEISMIC DETAILS AND CALCULATIONS

A. Submit details and calculations for support and anchors that are not specifically detailed on the Drawings where required by California Building Standards Code, California Code of Regulations, Title 24. Pre-approved systems may be used as noted below only if the pre-approval is current and accepted by the local agency having jurisdiction.

1.8 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

- a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- 1.10 DELIVERY, STORAGE, AND HANDLING
 - A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
 - B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- 1.11 ENVIRONMENTAL REQUIREMENTS
 - A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
 - B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2 - PRODUCTS

- 2.1 CONDUIT SUPPORTS
 - A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
 - B. Beam Clamps: Steel or Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
 - C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
 - D. Conduit clamps general purpose: One-hole malleable iron for surface mounted conduits.
 - E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.
- 2.2 FORMED STEEL CHANNEL
 - A. Product Description: 1 5/8 inches square Galvanized 12 gage thick steel. With holes 1-

1/2 inches on center.

- 2.3 SPRING STEEL CLIPS
 - A. Spring steel conduit hanger to threaded rod.

2.4 SLEEVES

- A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

- A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

2.7 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- C. General:
 - 1. Furnish UL listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- D. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular

space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide expansion anchors.
 - 2. Steel Structural Elements: Provide beam clamps.
 - 3. Concrete Surfaces: Provide expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide structural backing plate.
 - 5. Solid Masonry Walls: Provide expansion anchors.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Install conduit and raceway support and spacing in accordance with the California Electrical Code.
- C. Install all support devices according to manufacturer's guidelines and recommendations.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Do not drill through structural framing members.
- F. Do not support equipment or fixtures from the roof deck. Provide necessary framing and joist hangers to span between structural members to locate hangers properly.
- G. Install multiple conduits runs on common hangers.
- H. Supports:
 - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon

head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

- 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
- 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
- 4. Support vertical conduit at every floor.
- 5. Clip type hangers may be used in concealed areas on individual conduit runs.
- 6. Group mounted, exposed, or concealed raceways shall be supported by trapeze hangers constructed of formed steel channels and treaded rods.

3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items, requiring firestopping.
- B. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- C. Fire Rated Surface:

1.

- Seal opening at floor, wall, partition, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Pack void with backing material.
 - c. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- D. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
 - 4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.
- 3.6 INSTALLATION SLEEVES
 - A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
 - B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
 - C. Set sleeves in position in forms. Provide reinforcing around sleeves.
 - D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
 - E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
 - F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk.
 - G. Install chrome plated steel escutcheons at finished surfaces where penetrations occur below finished ceilings.
- 3.7 FIELD QUALITY CONTROL
 - A. Inspect installed firestopping for compliance with specifications.
- 3.8 CLEANING
 - A. Clean adjacent surfaces of firestopping materials.
- 3.9 PROTECTION OF FINISHED WORK
 - A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes.
- B. Related Sections:
 - 1. Section 26 05 29 Hangers and Supports for Electrical Systems.
 - 2. Section 26 05 53 Identification for Electrical Systems.
 - 3. Section 26 27 26 Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 Specification for Electrical Metallic Tubing, Zinc Coated.
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- C. Part 3, Title 24, California Electrical Code (CEC).

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size:
 - 1. 3/4 inch.
 - 2. 1 inch outside foundation line.

1.5 SUBMITTALS

- A. Product Data: Submit for the following:
 - 1. Metallic conduit.
 - 2. Electrical metallic tubing.
 - 3. Flexible metal conduit.
 - 4. Liquid tight flexible metal conduit.
 - 5. Nonmetallic conduit.
 - 6. Raceway fittings.
 - 7. Conduit bodies.
 - 8. Surface raceway.
 - 9. Wireway.
 - 10. Pull and junction boxes.
- B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
- C. Provide Seismic Shop Drawings from a structural engineer licensed in the state of California for any conduit support systems containing conduits 2.5" or larger in trade size or assemblies weighing over 10 lbs. per linear foot which are suspended further than 12" from the point attachment to the building structure to the top of the conduit or trapeze support systems.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inches.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.8 COORDINATION

- A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.
- B. Coordinate Work of this Division and Work of other Divisions in advance of installation. Provide additional Work to overcome tight conditions at no increase in Contract Sum.
- C. Coordinate installation of outlet boxes for equipment specified in other divisions.

PART 2 - PRODUCTS

- 2.1 METAL CONDUIT
 - A. Rigid Steel Conduit: ANSI C80.1.

- B. Intermediate Metal Conduit (IMC): Rigid steel.
- C. Fittings: NEMA FB 1. Fittings shall be steel with threaded fittings. Use insulated metallic bushings with lug where ground connections are required. Use plastic bushing for non-bonding applications.
- D. Conduit Bodies: Bodies connected to rigid steel or intermediate conduit shall be the cast iron. Provide matching gasketed stainless steel cover with at least two corrosion resistant screws. Die cast aluminum products are not permitted.
- 2.2 PVC COATED METAL CONDUIT
 - A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.
 - B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.
- 2.3 FLEXIBLE METAL CONDUIT
 - A. Product Description: Interlocked steel construction.
 - B. Fittings: NEMA FB 1; Fittings shall be steel insulated throat type rated as suitable for system ground continuity.
- 2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT
 - A. Product Description: Interlocked steel construction with PVC jacket. Minimum size shall be ³/₄."
 - B. Fittings: NEMA FB 1; fittings shall be liquid tight with watertight connectors when installed in damp or wet locations.
 - C. Connectors for liquid tight flexible conduit shall be screw-in ground cone type.
- 2.5 ELECTRICAL METALLIC TUBING (EMT)
 - A. Product Description: ANSI C80.3; galvanized tubing.
 - B. Fittings: NEMA FB 1; steel compression concrete tight couplings and connectors. Fittings shall meet same requirements for finish and material as EMT conduit. Box connectors shall have nylon insulated throat. Set screw type couplings are not permitted.
 - C. Fittings shall be assembled with anti-corrosion, conductive anti-seize compound at joints made tight to exclude water.
 - D. Conduit Bodies: Bodies shall be the cast iron. Provide matching gasketed stainless steel cover with at least two corrosion resistant screws. Die cast aluminum products are not permitted.

2.6 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC.
- B. Fittings: NEMA TC 3.
- C. Non-metallic conduit fittings shall be of the same material as the conduit furnished and be the product of the same manufacturer.
- D. PVC 90-degree bends shall not be used. Wrapped rigid conduit will be used in its place. Double lap of Calpico 10 mil or approved equal.

2.7 WEATHERPROOF CABLE TERMINATERS

- A. Product Description: Dust tight and liquid tight with sealing ring and insulated throat.
- B. Bushing shall be OZ/Gedney type KR or equal.
- 2.8 EXPANSION AND DEFLECTION FITTINGS
 - A. OZ/Gedney type DX or equal.
- 2.9 SURFACE METAL RACEWAY
 - A. Manufacturers:
 - 1. The Wiremold Co. Series 2000, 3000 4000, &6000.
 - 2. Approved equal.
 - B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
 - C. Wireway systems smaller than Wiremold series 700, or equal are not permitted.
 - D. Finish: Gray enamel.
 - E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.10 WIREWAY

- A. Product Description: Steel, general purpose or Raintight type wireway.
- B. Finish: Rust inhibiting primer coating with gray enamel finish.
- C. Wireway systems shall have dividers between line voltage and low voltage systems.

2.11 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2-inch male fixture studs where required.
 - 2. Boxes for shall be 1-1/2 inch deep by 4-inch square minimum.

- 3. Concrete Ceiling Boxes: Concrete type.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.12 PULL, SPLICE AND JUNCTION BOXES

- A. Indoor general-purpose boxes shall be a NEMA 1 enclosure, constructed of code gauge galvanized steel. The boxes shall be constructed from a single piece of steel with folded and welded corners. Boxes shall have hinged covers or flat removable, galvanized sheet metal covers held in place with binder head sheet metal screws.
- B. Outdoor boxes surface mounted above ground in wet locations shall be cast iron with a plain cast iron cover. Covers shall be neoprene gasketed and shall be NEMA 4 watertight construction. The cover shall be held in place by stainless steel screws.
- C. Size boxes based on code and working space requirements related to the number and size of conduits and wire entering the box.
- D. For recessed boxes, use an outside flanged recessed cover. For outdoor boxes mounted on exterior surfaces, use an un-flanged box with weather seals.
- E. Conduit openings shall be bossed, drilled, and tapped in outdoor boxes.
- F. Standard size metal boxes stamped from galvanized steel shall be used for indoor above ground general purpose where size and capacity are acceptable by code.
- G. Boxes shall be of the depth required for wiring capacity.
- H. Above ground outdoor boxes shall be cast iron with threaded hubs for vapor tight and wet locations where indicated.
- I. Boxes for hazardous (classified) locations shall be approved for the classification and use.
- J. Provide boxes with a blank cover.

2.13 UNDERGROUND BOXES

- A. Underground boxes 24-inches square or larger shall be high density reinforced concrete with end and side knockouts. All such boxes shall be back filled around the outside with concrete. Each shall be equipped with the following reinforced concrete accessories:
 - 1. Extensions as required.
 - 2. Box floor.

3. Lid with hold down bolts and labeled with usage. (Steel checker plate with hold down bolts in traffic areas.)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to roughin.

3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

- A. Contractor shall have reviewed and approved Seismic Shop Drawings prior to installation of raceways which require seismic support.
- B. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- C. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- D. Identify raceway and boxes in accordance with Section 26 05 53.
- E. Arrange raceway and boxes to maintain headroom and present neat appearance.
- F. Maintain minimum 12" clearance from top of suspended ceiling to bottom of conduits where possible.
- G. Electrical wiring, conduits and boxes may not be installed within 1 ½" of metal deck roofs.
- 3.4 INSTALLATION RACEWAY

- A. Provide completely separate raceways for the life safety, critical, equipment, and normal branch power systems in accordance with the CEC.
- B. Conceal all conduits, except in unfinished spaces such as equipment rooms or were indicated by symbol on the drawings or as approved by the University's Representative. Run concealed in areas having finished ceilings and furred walls.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Do not route flexible conduit through rated or non-rated walls.
- J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 2-inch clearance between raceway running perpendicular to piping with temperatures exceeding 104 degrees F.
- M. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Provide pull boxes or junction boxes in conduit runs over 90' long or when more than 4 quarter bends occur in a conduit run.
- R. Install conduit bodies to make sharp changes in direction, as around beams.
- S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- T. Install fittings to accommodate expansion and deflection were raceway crosses seismic, control or expansion joints.

- U. Fittings for IMC or rigid steel conduits shall be assembled with anti-corrosion, conductive anti-seize compound at joints made to exclude water.
- V. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- X. Close ends and unused openings in boxes and wireway.

3.5 USES PERMITTED

- A. Galvanized rigid conduit or IMC shall be used as follows:
 - 1. For primary and secondary service (except when installed below the ground floor slab and above the building mat slab) and for secondary unit substations, switchboard, motor control center, dry-type transformer, and panelboard feeders.
 - 2. Buried in or in contact with earth to be half-lapped with omic pipe wrapping tape with sealant applied to all joints.
 - 3. In poured concrete walls, floor, and roof construction, provided a minimum of 2" of cover is maintained.
 - 4. In all walls up to the first outlet box where fed from rigid conduit in damp locations or locations exposed to the weather.
 - 5. In exposed locations below 8 feet above the floor, including all mechanical rooms.
 - 6. All elbows for underground plastic conduit.
 - 7. All conduits for interior wiring systems whose voltage is above 600 volts.
 - 8. All conduits entering refrigerated spaces.
 - 9. Elsewhere where indicated on the drawings.
 - 10. For emergency branch feeders and circuits installed outside of building.
- B. Electrical metallic tubing (EMT) shall be used as follows:
 - 1. Concealed in stud partitions and hollow masonry walls.
 - 2. For connections from junction box to lighting fixtures except in accessible ceilings.
 - 3. In suspended or accessible ceilings above 8 feet.
 - 4. Exposed in dry locations above 8 feet where not subjected to mechanical damage.
 - 5. In furred ceiling spaces.
- C. Rigid non-metallic conduit shall be used as follows:
 - 1. For the branch circuit wiring for exterior lighting pole bases and bollards (horizontal runs only).
 - 2. All elbows, both vertical and horizontal, shall be GRC.
 - 3. Any non-metallic PVC conduit used for emergency power systems shall be schedule 80 PVC.
 - 4. The communications conduit shall be schedule 40 PVC.
- D. Flexible steel conduit shall be used as follows:
 - 1. Recessed lighting fixtures. (6ft max)

- 2. Motor connections.
- 3. Connection between fan plenum and structure.
- 4. At expansion joints.
- 5. At transformers and other equipment which produces vibration.
- 6. At damp and wet locations or where exposed to weather, flexible steel conduit shall be liquid tight type.
- 7. Up to 20 feet of length is permitted between receptacles and light fixtures within the same single room.
- 8. Tite-bite type connectors shall be used.
- 9. All flexible steel conduit shall be used with code sized ground wire installed.
- 10. All homeruns shall be in conduit, do not use flexible conduits for any homeruns routed to panels.
- E. All other conduit, unless excluded herein, not permitted in accordance with the California Electrical Code, or otherwise indicated on the drawings, shall be electrical metallic tubing (EMT).
- F. Conduit types shall not be mixed indiscriminately with other types in the same run, unless specified herein or required by the CEC.
- G. Use flexible conduit for connections to motors, dry type transformers, electrical duct heaters, unit heaters, and flush mounted lighting fixtures. Conduit must be secured.
 - 1. Flexible conduit used for connection of motor, dry type transformers, electric duct heaters, and unit heaters, shall not exceed 18" in length.
 - 2. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 feet in length.
 - 3. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
 - 4. Liquid tight conduit shall be used to connect equipment in mechanical equipment rooms and exterior installations, and for final connections to all equipment containing water or other liquid service.
- H. No conduit requiring cutting of cross-webs of concrete masonry units is permitted. Conduit shall be threaded through cells or concrete masonry units lowered around conduit. Neither horizontal joint reinforcement nor bond beam reinforcement shall be cut for conduit installation.
- I. Where hazardous locations, as classified by the CEC, exist, all conduits and fittings and the installation of these materials shall comply with Article 500.
- J. Direct Burial PVC Conduit
 - 1. Minimum size 1.0."
 - 2. Unless otherwise indicated install top of conduits 24" minimum below finished grade. All conduits not under building slabs or parking lots shall be encased in a minimum of 3" concrete. All concrete for primary conduit shall contain a red pigment dye to make it readily noticeable. Provide 10% red oxide per cubic yard of material.
 - 3. Install top of conduits 30" minimum below grade, below roads and any other paved surfaces.

- 4. Place a 4" wide, bright yellow, non-biodegradable plastic tape 12" above all underground conduit outside of building foundation.
- 5. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab, make transition with rigid galvanized elbow and extend through slab or above grade with galvanized rigid steel conduit. For corrosion protection, where the elbow penetrates surface, wrap with vinyl all-weather electrical tape for 6" above and below concrete surface.
- 6. For all underground runs of two or more conduits, separators or spacing blocks made of plastic or other suitable nonmetallic, non-decaying material shall be placed on not greater than four-foot centers. They shall be of the interlocking type both horizontally and vertically. Ducts shall be anchored to prevent movement during placement of concrete.
- K. Raceway Installations Within Concrete
 - 1. Conduits shall not be installed within shear walls unless specifically indicated on the drawings. Conduits shall not be run directly below and parallel with load bearing walls.
 - 2. Conduit stub-up penetrations through slabs shall be installed with the top of a threaded conduit coupling flush with the finished slab.
 - 3. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.

3.6 INSTALLATION - BOXES

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- C. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- F. In Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 24 inches from ceiling access panel or from removable recessed luminaire.
- G. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- H. Provide acoustical rated moldable putty pads for all boxes located in acoustic rated walls.
- I. Provide fire rated moldable putty pads for all boxes located in fire rated walls.
- J. Secure flush mounting box to interior wall and partition studs with screws, not nails. Use box support bracket with far side support leg for outlets installed on wall studs.

- K. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- M. Install adjustable steel channel fasteners for hung ceiling outlet box.
- N. Do not fasten boxes to ceiling support wires or other piping systems.
- O. Support boxes independently of conduit.
- P. Install gang box where more than one device is mounted together. Do not use sectional box.
- Q. Install gang box with plaster ring for single device outlets.
- R. Outlet boxes located below eight feet in exposed interior dry locations shall be one piece drawn steel or cast type.

3.7 INSTALLATION CONCRETE COMPOSITE BOXES

- A. Install boxes direct buried in earth or concrete flush with surface, square with surrounding structures.
- B. Provide hold down bolts for all covers.
- C. Provide minimum 12" depth of crushed rock or pea gravel below boxes for drainage. Ground bond steel cover plate with insulated green grounding conductor.
- D. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.8 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in other Sections.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- 3.9 ADJUSTING
 - A. Adjust flush-mounting outlets to make front flush with finished wall material.
 - B. Install knockout closures in unused openings in boxes.
- 3.10 CLEANING
 - A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Wire markers.
 - 3. Junction box identification.
 - 4. Inscribed cover plates.
 - 5. Underground Warning Tape.

1.2 QUALITY ASSURANCE

- A. Provide material supplied by a manufacturer producing identification systems.
- B. Comply with OSHA, NFPA or local jurisdiction identification requirements for electrical systems.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Provide engraved plastic-laminate sign on each major unit of electrical equipment in building, including:
 - 1. Electrical cabinets, panels, switchboards, and enclosures.
 - 2. Transformers.
- B. Each individually mounted circuit breaker, and each breaker in the switchboards, secondary unit substations, and distribution panels shall have a nameplate.
- C. Nameplates shall have ½" high text lettering on 1-1/2" high nameplate (with 2" high used for nameplates with multiline text).
- D. Nameplates shall be color coded to match existing electrical system.
- E. Equipment identification is to indicate the following:
 - 1. Equipment ID abbreviation.
 - 2. Voltage, phase, and wires.
 - 3. Power source description or system.
 - 4. Power source origination.
 - 5. Example: Panel SLGHA1; 480/277V, 3 Ø, 4 W.

- 6. Life Safety System; Fed by EM1
- F. Minimum nameplate thickness: 1/16 inch for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Furnish with pre-punched holes for mechanical fasteners.
- G. All electrical devices and switches shall have engraved device covers, 1/8" high letters. Include panel name and circuit number.

2.2 BOX IDENTIFICATION:

- A. After completion, using an indelible wide tip marker, indicate on the cover of each junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5.
- B. After box installation and wire termination completion all junction box and pull box covers shall be field marked/painted as follows:
 - 1. Normal branch power circuits "Green"
 - 2. Emergency branch power circuits "Red"
- 2.3 WIRE MARKERS
 - A. Description: Self-adhering, pre-printed or machine printable, self-laminating vinyl wrap around strips. Inscribe blank markers using the printer recommended by the manufacturer for this purpose.
 - B. All conductors shall be marked and identified. Include voltage, phase, and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present.
 - C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
 - 2. Control Circuits: Control wire number as indicated on shop drawings.
- 2.4 CONDUCTOR PHASE MARKERS
 - A. Colored vinyl plastic electrical tape, 3/4 inch wide, for identification of phase conductors.
- 2.5 UNDERGROUND WARNING TAPE
 - A. Description: 6-inch-wide plastic tape, detectable type, colored yellow or red with suitable warning legend describing buried electrical lines.
- 2.6 LOCKOUT DEVICES
 - A. Lockout Hasps:
 - 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates, labels, and markers.
- D. Provide updated, type written, panelboard schedules for all branch circuit work completed as part of renovation and/or new construction projects. Schedules shall include the load description and the room number or area installed.

3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
 - 1. Install nameplate parallel to equipment lines.
 - 2. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
 - 3. Fasteners for equipment or device tag identification shall be self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot be used or should not penetrate the substrate material of the equipment.
- C. Nameplates for signal systems equipment and devices are to be black except as follows:
 - 1. Fire alarm and life safety White with red letters.
- D. Inscribed Electrical Device Cover plate:
 - 1. General: Lettering type shall be Helvetica, 12 point or 1/8" high. Color of characters shall be black. Locate the top of the inscription 1/2" below the top edge of the cover plate. Inscription shall be centered and square with cover plate.
 - 2. Provide inscribed cover plates for devices as outlined below:
 - a. Receptacles and switches.
 - b. Outlets in surface raceways.
 - c. Multi-ganged (four or more) switch arrangement.
 - d. Special purpose switches, i.e., projection screens, shades, exhaust fans, etc.
- E. Wire Marker Installation:
 - 1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
 - 2. Provide colored plastic phase tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made.
- F. Box Identification:
 - 1. After completion, using an indelible wide tip marker, indicate on the cover of each

junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5.

- 2. All junction and pull boxes for wiring systems above 600V shall be identified with high voltage warning labels installed every 20 linear feet in accordance with OSHA standards. All boxes shall also be painted red.
- G. After box installation and wire termination completion all junction box and pull box covers shall be field marked/painted as follows:
 - 1. Normal branch power circuits "Green"
 - 2. Emergency branch power circuits "Red"
- H. Conduit and Raceway Identification:
 - 1. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

3.4 UNDERGROUND WARNING TAPE:

- A. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.
- 3.5 BRASS TAGS:
 - A. Provide brass tags for all feeder cables in underground vaults and pull boxes.
 - B. Provide brass tags for empty conduits in underground vaults, pull boxes and stubs.
- 3.6 WARNING, CAUTION, AND INSTRUCTION SIGNS
 - A. Provide warning, caution or instruction signs where required by OSHA, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems.
 - 1. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system of equipment operation.
 - 2. Provide polyester film self-adhesive signs of indoor/outdoor equipment and door warning. Use rigid polyethylene non-adhesive signs where adhesives will not work; for example, installing on a metal fence. Provide sign color and marking that meets OSHA regulations. For example, DANGER (red background with white letters), HIGH VOLTAGE (white with black letters.
 - a. Use 2 by 4-inch signs for small equipment or enclosure doors.
 - b. Use 7 by 10 inch or 10 by 14-inch signs for large equipment or enclosure doors.
 - B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- 3.7 FIRESTOPPING

A. Firestopping shall be labeled at each location where installed, on each side of the penetrated fire barrier, and within 12 in. of the firestopping material.

END OF SECTION

SECTION 262726 WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wall switches; receptacles; multioutlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 General Requirements for Wiring Devices.
 - 2. NEMA WD 6 Wiring Devices-Dimensional Requirements.
- 1.3 SUBMITTALS
 - A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
 - B. All switches, receptacles and device plates throughout project shall be from the same manufacturer unless otherwise specified.
- 1.4 QUALIFICATIONS
 - A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Pass & Seymour
 - 2. Leviton
 - 3. or equal
- B. Product Description: Industrial Grade, NEMA WD 1, Heavy-Duty, AC only quiet toggle switch.
- C. Body and Handle: Ivory thermoplastic with toggle handle red color for devices connected to emergency power system.
- D. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

- E. Indicator Light: Separate pilot strap; red color lens.
- F. Locator Light: Lighted handle type switch; green color handle.
- G. Ratings:
 - 1. Voltage: 120-277 volts, AC.
 - 2. Current: 20 amperes.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Pass & Seymour
 - 2. Hubbell
 - 3. Leviton
 - 4. Cooper
 - 5. Approved equal.
- B. Product Description: Hospital Grade, NEMA WD 1, Heavy-duty general use receptacle. Grounding system shall be all brass and integral to the wrap around mounting strap. Combination head brass grounding screw. Brass alloy triple wipe contacts shall grip both sides of plug prongs.
- C. Device Body: Ivory thermoplastic. Red for devices connected to Emergency circuits.
- D. Wiring: Back and side wired. Back wiring with wrap-around steel strap clamp type terminals suitable for stranded or solid wire.
- E. Configuration: NEMA WD 6, type as indicated on Drawings.
- F. Convenience Receptacle: Duplex type 5-20.
- G. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- H. Tamper Resistant Receptacle: Convenience receptacle with internal spring-loaded mechanical shutter. Type 5-20.
- I. Special Purpose Receptacles: Type and rating and number of poles indicated or required for the anticipated purpose.

2.3 WALL PLATES

- A. Color, Material and Locations:
 - 1. Stainless Steel: Brushed stainless steel with stainless steel screws at all locations, except as indicated below.
 - 2. Unfinished Areas: In tunnels, above ceilings and in unfinished areas, device plates shall be galvanized steel utility type.
 - 3. Weatherproof Outlets: Provide cast aluminum plate with a hinged backing double lift cover and gasket allowing either surface or recessed mounting. Plate shall allow horizontal mounting of a duplex receptacle with a horizontal hinge. Hubbell #5205

or equal for standard boxes or Hubbell #5206 or equal for FS boxes. GFI outlets shall be provided with an appropriate cover.

B. Weatherproof Wet Location Cover Plate: Extended polycarbonate hinged cover for use when attachment plug is inserted.

2.4 MULTIOUTLET ASSEMBLY

- A. Multi-outlet Assembly: Sheet metal channel with fitted cover, suitable for use as multioutlet assembly.
- B. Size: As indicated on Drawings.
- C. Receptacles: Furnish covers and accessories to accept receptacles specified in this Section.
- D. Receptacles: NEMA WD 6, type 5-15R.
- E. Receptacle Spacing: As indicated on Drawings.
- F. Channel Finish: Gray enamel.
- G. Fittings: Furnish manufacturer's standard couplings, elbows, and connectors

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 **PREPARATION**

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.
- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

- B. Mounting heights shown shall be measured from finished floor to the center of the outlet box.
- C. Install switches with OFF position down.
- D. Install all outlet boxes for light switches flush in wall where possible. Where more than one switch appears at the same location, they shall be installed in a ganged box with a single plate.
- E. Where receptacles are shown adjacent to other devices, the boxes shall be installed with 2" between devices of other systems.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Terminate ground wire at device where ground wire is provided within the raceway system.
- J. Carefully strip thermoplastic wire to length and make-up terminal connection as recommended by the device manufacturer.
- K. Secure device to outlet box with proper screws.
- L. Use jumbo size plates for outlets installed in masonry walls.
- M. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- 3.5 Labels and Inscriptions:
 - A. Identify receptacle cover plate with panel and branch circuit number (for example L2A-3). Engrave and fill with 1/8" high black letters. Red for emergency system outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.
- 3.7 FIELD QUALITY CONTROL
 - A. Inspect each wiring device for defects.
 - B. Operate each wall switch with circuit energized and verify proper operation.
 - C. Verify each receptacle device is energized.
 - D. Test each receptacle device for proper polarity and grounding.
 - E. Test each GFCI receptacle device for proper operation.

3.8 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.9 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes, but is not necessarily limited to, common standards and procedures for the Communications Work.
- B. This Section outlines areas of responsibility between Owner, Architect, and Contractor.
- C. Owner will assist with a collaborative process to determine the most cost effective and efficient means to reach the common goal of providing communications within the facility for the project, including assessing user needs and assessing required pathways. The Owner is available upon request to assist at no additional cost to the project. It is incumbent upon the construction team management to approach and engage the Owner at the appropriate times for collaboration.
- D. As part of the project, the construction team must design, engineer, and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Communications Systems; and provide engineering of such support by parties licensed to perform work of this type in the project jurisdiction.

1.2 ITEMS PROVIDED BY OWNER

- A. Registered Communications Distribution Designer (RCDD) support services
- B. IT project management
- C. Submittal approvals
- D. Network equipment
- E. 802.11 Wireless Access Point hardware
 - 1. Installation by construction team when wireless access point mounting requires seismic support or a construction activity such as screwing, drilling, or welding.
 - 2. Owner will provide 802.11 design services.
- F. Rack and Stack
- G. Plug Pack Distribution (Pre-terminated switch port cabling provided and installed by the Owner)
- H. Patch Cords and Patching
- I. IT UPS System (installation by construction team)
- J. PDU Power distribution Equipment
- K. VOIP Router, Voice Gateway, VOIP equipment
- L. Camera NVR/Server
- M. Overhead Paging Amplifier
- N. TV Distribution Amplifier
- 0. Closet Cleaning postproduction

1.3 ITEMS PROVIDED BY CONSTRUCTION TEAM

- A. Building Drawings and Floor Plans
- B. Site Plans
- C. Furniture Plans
- D. As-Built Drawing Submittals
 - 1. As-built drawing per section 1.10
 - 2. Cabling Schedule
 - 3. Desktop Inventory Sheet
 - a. Spread sheet listing cable number and location for every cable installed.
 - 1) Cable number; room number, wall (north, south, east, west)
- E. Attachments to structure
- F. In wall cabling
- G. In wall cabling supports
- H. Wireless Access point seismic support installation where required.
- I. Cabling test results
- J. Patch Panels
- K. Horizontal Wire Managers
- L. Vertical Wire Managers (installation by construction team)
- M. Racks for mounting cabling and equipment (installation by construction team).
- N. Horizontal cable, jacks, faceplates, surface mount boxes, cable trays, termination hardware, and all materials needed for a complete horizontal cabling plant as defined in the Section and associated Sections and the construction documents not otherwise listed for provision by the Owner.
- 0. Fiber housing, cassettes, and splicing.
- P. Construction Clean Closet Cleaning
- 1.4 RELATED SECTIONS
 - A. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
 - B. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
 - C. 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS SYSTEMS
 - D. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.5 REFERENCES AND STANDARDS

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
 - 1. UC Davis Health Telecommunications Standards
 - 2. American National Standards Institute (ANSI)
 - 3. Telecommunications Industry Association (TIA)
 - 4. Building Industry Consulting Services International (BICSI)

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- 5. American Society for Testing and Materials (ASTM)
- 6. Institute of Electrical and Electronic Engineers (IEEE)
- 7. National Electrical Manufacturers Association (NEMA)
- 8. Underwriters Laboratories, Inc. (UL)
- 9. Local Authorities Having Jurisdiction (AHJ)
- B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
 - 1. United States Department of Labor (DOL) Regulations (Standards 29 CFR)
 - 2. Part 1910, "Occupational Safety and Health Standards"
 - 3. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).
 - 4. 2022 California Building Code (CBC).
 - 5. 2022 California Fire Code (CFC).
 - 6. 2022 California Mechanical Code (CMC).
 - 7. National, State and any other binding building and fire codes.
 - 8. FCC Regulations:
 - a. Part 15 Radio Frequency Devices & Radiation Limits
 - b. Part 68 Connection of Terminal Equipment to the Telephone Network
 - 9. Underwriter's Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
 - a. UL 444: Communications Cables
 - b. UL 497: Protectors for Paired-Conductor Communication Circuits.
 - c. UL 1651: Optical Fiber Cable
 - d. UL 1690: Data-Processing Cable
 - e. UL 1963: Communications-Circuit Accessories
 - f. UL 2024A: Optical Fiber Cable Routing Assemblies.
 - 10. ANSI/TIA/EIA-568.1-E Commercial Building Telecommunications Cabling Standard.
 - 11. ANSI/TIA/EIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 12. ANSI/TIA/EIA-598-D Optical Fiber Cable Color Coding.
 - 13. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - 14. ANSI/J-STD-607-D Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - 15. ANSI/TIA/EIA-758-B Customer-Owner Outside Plant Telecommunications Cabling Standard.
 - 16. EIA testing standards.
 - 17. Insulated Cable Engineers Association (ICEA):
 - a. ANSI/ICEA S-83-596-2016 Fiber Optic Premises Distribution Cable
 - b. ANSI/ICEA S-87-640-2023 Fiber Optic Outside Plant Communications Cable

- c. ANSI/ICEA S-90-661-2021 Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems
- d. ICEA S-104-696-2019 Standard for Indoor-Outdoor Optical Cable
- 18. Telecommunications Distribution Methods Manual (TDMM)
- 1.6 ABBREVIATIONS
 - A. ADA Americans with Disabilities Act
 - B. AFC Above Finished Ceiling
 - C. AFF Above the Finished Floor
 - D. BDF Building Distribution Frame See Telecommunications Room (TR)
 - E. BLDG Building
 - F. CAT Category (Related to network cable types)
 - G. DIV Division
 - H. (E) Existing
 - I. ER IT Equipment Room See Telecommunications Room (TR)
 - J. GE Grounding Equalizer Part of the Telecom Grounding System
 - K. HR Homerun
 - L. ID Inside Diameter
 - M. IDF Intermediate Distribution Frame See Telecommunications Room (TR)
 - N. IT UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)
 - 0. LAN Local Area Network
 - P. MAX Maximum
 - Q. NIC Not in Contract
 - R. OD Outside Diameter
 - S. TBB Telecom Bonding Backbone Part of the Telecom Grounding System
 - T. TGB Telecommunications Ground Busbar
 - U. TMGB Telecommunications Main Ground Busbar
 - V. TR Telecommunications Room, TR may also be used interchangeably with ER, IDF, MDF, or Communications Room
 - W. TYP Typical
 - X. UCD UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)
 - Y. UFE University Furnished Equipment
 - Z. UON Unless Otherwise Noted
- 1.7 DEFINITIONS
 - A. Telecommunications Room (TR) An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling. The minimum size of a TR shall be 10' x 16.'
 - B. Intermediate Distribution Frame (IDF) See Telecommunications Room (TR)

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- C. Entrance Facility (EF) (Telecommunications) An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space. The minimum size of a TR shall be 10' x 16.'
- D. Pathway A physical infrastructure utilized for the placement and routing of telecommunications cable.
- E. Infection Control Clinical Environment Infection Control or ICRA
- F. "Cabling": A combination of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].
- G. "Identifier": A unique code assigned to an element of the telecommunications infrastructure that links it to its corresponding record.

1.8 QUALITY ASSURANCE

- A. Contractor Firm Qualifications:
 - 1. All work for the Communications (low voltage) Infrastructure installation shall be self-performed by the Communications Contractor; subcontractors shall not be allowed under the Communications Contractor unless approved by UCDH.
- B. Communications Contractor shall:
 - 1. Be a Panduit Corp. PCI (Panduit Certified Installer) Design and Installation Contractor or approved equal.
 - 2. Be a firm which is regularly and professionally engaged in the installation and testing of the specified communications equipment and infrastructure.
 - 3. Be licensed to install low voltage electronic cabling systems in the State of California where applicable (C7 License).
- C. Communications Contractor shall demonstrate experience in providing successful installation of data infrastructure systems:
 - 1. Submit documentation for a minimum of three and a maximum of five successful low voltage communications infrastructure system installation projects completed within the past three years.
- D. Contractor Key Personnel Qualifications:
 - 1. Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified low voltage communications systems, equipment, and infrastructure. There may be one key person or more key persons proposed for this project depending upon how many of the key roles each has successfully provided.
 - 2. Each of the key personnel shall demonstrate experience in providing successful low voltage communications systems, equipment, and infrastructure within the past three years.
- E. A Registered Communications Distribution Designer (RCDD) shall be employed by the Design Builder and directly engaged in the project for all Communications Infrastructure design and installation efforts.
 - 1. The RCDD shall be a direct employee of the Communications Contractor, within the Design Build team structure.
 - 2. The RCDD shall be required to have oversight and supervision of the entire Communications Infrastructure installation process and quality control.

- 3. The RCDD shall be the Design Builder's Designer of Record for the Communications Infrastructure scope of work.
- 4. RCDD direct responsibilities shall include but may not be limited to: Thorough coordination with Owner regarding all design and installation efforts related to the project. A Pre-construction coordination meeting and site inspection with Owner prior to beginning any work. Oversight of Communications installation efforts, development of shop drawings and assembly of product data submittals. Quality control review and stamping of finalized Communications as-built drawings for submittal to Owner. Quality control review of Communications systems installation throughout the entire construction phase, to ensure all work is performed in compliance with approved construction drawings.
- F. Critical on-site quality control installation reviews to be conducted in conjunction with Owner technical staff shall include but may not be limited to:
 - 1. Validation of design to conform with Infection Control guidelines required as it applies with the type of structure and services to be provided in each specific area.
 - 2. Verifying proper installation of all Communications cable tray, backbone conduits, device back boxes, conduit infrastructure and cabling pathways. Site inspection and sign-off must be performed prior to concealing conduit infrastructure and prior to the installation of any low-volt cabling.
 - 3. Verifying proper installation of all Communications cabling. Site inspection and sign-off must be performed prior to closing-up associated accessible ceilings.
 - 4. Verifying the layout and installation of all equipment and cabling within the Telecom Rooms, throughout the duration of the construction phase.
- G. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. Submit documentation for a minimum of three and a maximum of five successful cabling system installations for each of the key personnel in an environment resembling that which is being bid upon.
 - In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of three years' experience in the installation of the specified copper and fiber optic cable and components. The personnel on site performing work pertaining to this job shall be certified on the system being installed. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.
 - 2. Submit documentation for a minimum of three and a maximum of five successful cabling system installations for each of the key personnel in an environment resembling that which is being bid upon. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this project. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems.
 - 3. All the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this project.

- 4. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project Owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.
- H. Indicate that all key persons are currently employed by the Communications Contractor or have a commitment to the Communications Contractor to work on this project. All key persons shall be employed by the Communications Contractor at the date of issuance of this project, or if not, have a commitment to the Communications Contractor to work on this project by the date that the bid was due to the Owner's Representative.
 - Note that only the key personnel approved by the Owner's Representative in the successful proposal shall perform work on this project's low voltage systems, equipment, and infrastructure. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the Communications Contractor's key personnel require approval from the Owner's Representative.
- I. Designated Supervisor: Designate which key person will serve as a designated supervisor for the project. This supervisor shall be present and responsible for the project site during all phases of installation and testing of the Work in this Section. This supervisor shall be the same individual through the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
- 1.9 SUBMITTALS
 - A. All Submittals shall be provided electronically in PDF format. All Drawing Submittals shall be provided in PDF and AutoCAD (latest version) DWG format.
 - B. Submittals shall be organized in a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.
 - C. Contractor shall submit the following items:
 - 1. Contractor Key Personnel and Certifications
 - 2. Complete Bill of Materials (BOM) List
 - 3. Manufacturer Product Data Sheets, as defined below.
 - 4. Shop Drawings, as defined below.
 - 5. Proposed Installation Schedule
 - 6. Cabling Certification Test Plan and proposed test equipment
 - D. Manufacturer Product Data Submittals shall include:
 - 1. Submit product data sheets for all equipment being provided.
 - 2. Collate in sequence by Section Number, and clearly mark proposed product on data sheet. Include Safety Data Sheet, where applicable.
 - 3. Clearly identify any proposed product substitutions or known deviations.
 - E. Precede each submittal book with a summary TOC. per example schedule below:
 - 1. Specification Section
 - 2. Drawing Reference

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- 3. Manufacturers Model No.
- F. The following is a general summary list of Submittal items required to be delivered at 30-day burn-in period.
 - 1. As part of project close-out activities, Contractor shall submit Record Documents for review and approval by the Owner.
 - 2. All Record Documents shall be provided electronically in PDF format. All Record Document Drawings shall be provided in PDF and AutoCAD (latest version) DWG format.
- 1.10 CLOSEOUT SUBMITTALS
 - A. Contractor shall submit the following items:
 - 1. Record As-Built Shop Drawings indicating the final, 'as-built' condition of all associated equipment, infrastructure, and work.
 - B. Shop Drawing Submittals shall include:
 - 1. Drawing index/symbol/schedule sheet.
 - 2. Clearly indicate all new work versus existing work.
 - 3. Site Plans, Floor Plans, and Reflected Ceiling (work 7' AFF+)
 - 4. Drawings shall be developed in AutoCAD .DWG format, utilizing most current architectural backgrounds available for the project.
 - 5. All drawings shall be properly scaled.
 - 6. Indicate all device locations and types. Include addressing for all network outlets.
 - 7. Indicate all cabling routes, types, and quantities.
 - 8. Indicate all conduit routing, quantities, sizes, and wire fill. Indicate basket tray and J-hook routes.
 - 9. Indicate fire stopping requirements for all penetrations.
 - 10. Indicate 'cable bundle groups' no larger than:
 - a. CAT6A 74
 - 11. When bundling low voltage cabling together the lowest common denominator determines the largest cable group allowed unless the cable is LP listed.
 - C. Riser Diagrams indicating:
 - 1. Backbone cabling and termination locations. Associated cabling pathways, sizes, and cable fill. Telecommunications Grounding System.
 - D. Enlarged Room Plans and Elevations indicating:
 - E. Provide dimensioned drawings for all telecommunications rooms. Complete, dimensioned rack and wall elevations of all equipment. Consideration must be given to equipment heights within. Plywood backboards and grounding equipment.
 - F. Racks, cabinets, cable tray, ladder rack, wire management. Termination equipment for all copper and fiber cabling. Conduit and cable entrance points and fire stopping. Electrical panels, power circuits and HVAC provisions.
 - G. Ensure coordinated arrangement of equipment with other trades. Typical Device Installation Details indicating: J-hooks, conduit, cable tray, and associated support systems. Network outlet faceplate layout and wiring terminations. Device back box and conduit rough-in requirements.
 - H. Details of other associated devices and equipment.

- I. The shop drawing package must be stamped and signed by a Registered Communications Distribution Designer (RCDD). Signatures by a Professional Engineer (PE) licensed in the project jurisdiction for work of this type as required by the AHJ.
- J. Cable Certification Test Results. Submit electronically in native format and include associated software license as applicable.
- K. Completed punch list reports.
- L. Manufacturer Operation and Maintenance (O&M) Manuals.
- M. Warranty information.
- N. Keys and any portable equipment.

1.11 WARRANTY SERVICE

- A. Closeout Submittals, Warranties and Guarantees, provide the following.
 - 1. Response Time: Provide a qualified technician familiar with the work at the project site within four hours after receipt of a notice of malfunction. Provide the Owner's Representative with telephone number attended 10 hours a day, five days a week, to be called in the event of a malfunction.
 - 2. Provide all Warrantees as defined in each Communication Systems Section.
- B. PanGen Structured Cabling Solutions System Warranty
 - Contractor shall provide a Panduit Certification Plus System Warranty on all installed copper and fiber permanent links. Such warranty shall provide a complete system warranty to guarantee high end-to-end performance for all applications designed to operate over the class of cabling installed. The guarantee shall include all connectivity components and cable within the permanent link and cover the system for duration of 25 years.

PART 2 - MATERIALS

- 2.1 COMMUNICATIONS SYSTEMS PRODUCTS SUMMARY
 - A. The following is a general summary list of Communications Systems equipment, components, and cabling required for the project. This is not intended to be a comprehensive list of materials. See additional Sections for complete materials requirements.
 - B. Racks: Seismic racks shall be RXL (# RXL-2823-BK80T). Standard racks shall be RXL (# RXL-2200-BK80T). Racks will be 8' high for new builds and remodels where space is available. 7' high racks will be used as an alternate where space is not available for taller racks.
 - C. Wire Managers: Panduit PE2V Series full height vertical cable manager.
 - 1. 10" Wide Front/Back unless otherwise noted on plans.
 - 2. 96 inch or 84 inch sized to match the racks being installed.
 - D. Primary Bonding Busbar (PBB) & Secondary Bonding Busbar (SBB); CPI_Mfg.Part:40153-012
 - E. Data Patch Panels: Panduit CP48BLY

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- F. Fiber Terminations: LC
- G. Modular Jack CAT6A
 - 1. Panduit Mini-Com CJ6X88TGVL
 - 2. Colored Icons as needed per UC service designation.
 - 3. Icons are Panduit PAN_CID(XX) (gray for cables in ceiling)
- H. Copper cabling, Category 6A (Data)
 - 1. High Speed, TIA Category 6A cabling, Plenum Rated
 - 2. General Cable GenSpeed 6A Part No. 7151855 Purple
- I. Copper cabling, Category 6A Shielded (VOIP Paging)
 - 1. High Speed, TIA Category 6A cabling, Plenum Rated
 - 2. General cable GenSpeed 6A Part No. 7151855 purple
- J. Telecommunications Outlets (Workstation side)
 - 1. Modular Furniture Surface Mount Box, Black
 - 2. Panduit CBX2BL-AY (2-port), CBX4BL-AY (4-port)
 - 3. Modular Surface Mount Box Attachment System Mini-Com CBM-X magnetic
 - 4. Modular Surface Mount Box Blank Insert Panduit CMB(BL)
- K. Faceplate (Workstation side)
 - 1. Panduit Mini-Com Stainless Steel Faceplates Single Gang CFP {2,4,6} SY or Double Gang CFP {4,8,10} S-2GY
 - 2. Faceplate Blank Insert Panduit CMB(WH)

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS SPACES

- A. Telecom Room (TR) minimum size 10' x 16'.
- B. UC Davis Health Telecommunications Standards do not include provisions for AV, unless otherwise indicated in the Design Criteria for the project. IT will be cooperative in assessing some parameters as they interact with IT support systems.
- C. Telecommunication Spaces are to use EZ-Path Fire-Rated Pathways systems for cabling access.
- D. Provide 36" of working clearance in front and back of racks and electronic equipment.
- E. A positive pressure type of HVAC system using hot and cold aisles.
- F. Walls shall be covered with fire-resistant treated plywood from 6" AFF to 8'6" AFF, and all surfaces sealed to mitigate airborne dust.
- G. IT uses a typical three-rack configuration with a B-line seismic for equipment and a standard 19" rack for cabling. Vertical wire management for planning shall be sized at 10" unless otherwise noted on the drawings.
- H. Lighting shall be provided with a minimum of 500 lux (50 foot-candles) measured at any point in the TR, including 6 inches above the finished floor. Photometrics shall consider position of racks and equipment and light fixtures shall be placed to prevent shadows between rows of equipment racks.

- I. TR Floors shall be covered in VCT (Vinyl Composition Tile) or Epoxy. Sealed concrete is not acceptable.
- J. Mechanical equipment of fixtures that are not directly related to the support of the TR shall not be installed of pass through the TR per California Mechanical Code 2022: 320.4.2.
- K. Plumbing Equipment and fixtures that are not directly related to the support of the TR shall not be installed in or pass through the TR per California Plumbing Code 2019: 310.13
- L. Electrical equipment and fixtures that do not serve the TR shall not be installed in or pass through the telecom room per California Electrical Code 2019.517.24

3.2 RACK COMPONENTS AND ELEVATIONS

- A. Owner will develop an equipment layout and rack elevation including the Telecom Room (TR) layouts. Typical components within the TR include, but not limited to:
 - 1. Network Equipment
 - 2. Fiber Termination Unit
 - 3. UPS/ PDU I Power distribution
 - 4. NM2/ NM4/ Horizontal wire management
 - 5. VOIP Router/Voice Gateway
 - 6. VOIP transition equipment
 - 7. Voice cabling
 - 8. Distribution Patch Panels
 - 9. Clinical Engineering Equipment
 - 10. Plug Pack Distribution
 - 11. Camera NVR /Server
 - 12. Nurse Call Devices
 - 13. Overhead Paging Amplifier
- B. See related Sections for materials provided by the Owner and those furnished by the Contractor.

3.3 EXAMINATION

- A. Conditions: Verify conditions, provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Pathways: Verify that pathways and supporting devices, provided under other sections, are properly and permanently installed, and that temporary supports, devices, etc., have been removed.
- C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, "true tape" the conduits to verify cabling distances.

3.4 FIELD QUALITY CONTROL

A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule.

- B. Project Management: Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute meeting agenda prior to and meeting notes after meetings in a format acceptable to the General Contractor.
- C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the General Contractor. Issue schedule to General Contractor for approval. Prepare and issue updated schedules whenever there are modifications.
- D. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

3.5 INSTALLATION

- A. Conform to applicable federal, state, and local codes, and telephone standards.
- B. Attend one pre-construction meeting with the Owner to coordinate the requirements of the communications systems.
- C. Coordinate the entire installation with the General Contractor, and their subcontractors, to meet the construction schedule. Include coordination meetings as required to fulfill this requirement.
- D. Manufacturer's Instructions:
 - 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
- E. Maintain jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

3.6 REPAIR/RESTORATION

- A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.
- B. Paint damaged areas to existing painted surfaces caused by Work.
- C. Punch List:
 - 1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
 - 2. Provide punch list to Owner for review prior to performing punch walk with Owner.
- D. Re-Installation:
 - 1. Make changes to adjust the system to optimum operation for final use. Make changes to the system such that any defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.
 - 2. Repair defects prior to system acceptance.
- E. Cleaning
 - 1. Clean daily. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.

- 2. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.
- 3. Repair or replace damaged installed products.
- 4. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Legally dispose of debris.

3.7 DEMONSTRATION

- A. On completion of the acceptance test, schedule a time convenient with the Owner or Owner's Representative for instruction in the configuration, operation, and maintenance of the system.
- B. Provide 4 hours, minimum, of on-site orientation and training by a factory-trained representative. Document dates and times of training and submit a "sign in" sheet for individuals trained, as part of the close out documentation.

3.8 CERTIFICATION

A. Provide to Owner or Owner's Representative a written form of acceptance for signature. Corrections must be completed before Owner or Owner's Representative and Engineer will give acceptance.

END OF SECTION
SECTION 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the provision of communications supports and cable hook system as described in this specification, including but not limited to:
 - 1. Strut supports.
 - 2. Cable hooks (J-hooks)
 - 3. Beam clamps.
 - 4. Concrete fasteners
 - 5. Touch-up materials
 - 6. Conduit supports.
 - 7. Equipment supports.
 - 8. Fastening hardware
 - 9. Poke-through device.

1.2 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of communications equipment specified for this project.
- B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.3 SEISMIC REQUIREMENTS

- A. Seismic design requirements criteria, as shown on all drawings related to the project, including architectural and structural, as defined below shall apply to all work defined within the following specification sections:
 - 1. SECTION 27 05 00 COMMUNICATIONS HORIZONTAL CABLING
 - 2. All support systems and termination apparatus associated with the telecommunications system.
- B. Contractor to install seismic restraints for all telecommunications racks and UPS systems. In accordance with construction documents. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- C. Installation according to engineered drawings and anchorage calculations provided by the structural engineer in accordance with California Code of Regulations, Title 24, 2007 California Building Code.
- D. Supports for such items, including racks, conduit, cable trays and similar shall provide support, bracing, and anchorage, designed by the structural engineer in accordance with CBC Chapter 16A.

E. Supports to be sized to suit load and selected to match mounting conditions.

1.4 REFERENCES

- A. Comply with References requirements of Section 27 05 00
- B. In additional to those codes, standards, etc., listed in Section 27 05 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
 - 1. ASTM A 510 Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - 2. ASTM B 633 Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
 - 3. ASTM A 653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process.
 - 4. ASTM A 591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.
 - 5. ASTM A 123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

1.5 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- C. 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS SYSTEMS
- D. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.6 DEFINITIONS

- A. Definitions as described in Section 27 05 00 shall apply to this section.
- B. "Cable Hanger": A metal, most often steel, cable support device shaped (section view) similar to the letter J; alternately, a fabric strap. The device is available in different sizes supporting different quantities of cables and is also available with different attachment hardware to be supported by different methods (e.g., wire support, beam flange clip, etc.).
- C. Cable Runway or Ladder Rack: Overhead means to get cabling from point to point whether it be vertical or horizontal within Telecommunications Spaces such as TR's and the TER.
- D. "J-Hook": Another name for cable hangers.

PART 2 - PRODUCTS

2.1 FASTENERS, STRAPS, AND BEAM CLAMPS

- A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
 - 1. Concrete fasteners
 - a. Hilti.
 - b. Phillips "Red-Head."

- c. Remington.
- d. Ramset.
- e. Simpson Strong-Tie.
- f. Or approved equal.
- 2. Concrete inserts and construction channel:
- a. Unistrut Corp.
- b. GS Metals "Globe Strut."
- c. Thomas & Betts.
- d. "Kindorf" Corp.
- e. Or approved equal.

- 3. Conduit straps:
 - a. 0-Z/Gedney.
 - b. Erico "caddy" Fastening Products.
 - c. Thomas & Betts.
 - d. "Kindorf" Corp.
 - e. Or approved equal.
- 4. Beam Clamps
 - a. Cooper B-line.
 - b. Super Strut.
 - c. Unistrut.
 - d. Or approved equal.

2.2 CABLE HANGERS

- A. Ceiling Hung J-Hooks
 - 1. Specifically intended to carry the load of up to 74 communications cables without applying excess forces to cables at bottom of bundle.
 - 2. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8" cable bearing surface.
 - 3. Integral hanger rod attachment hardware at top. Load rated for application.
 - 4. Incorporates smooth 90-degree radius edges to prevent snagging cable jackets on installation.
 - 5. Designed so the mounting hardware is recessed to prevent cable damage.
 - 6. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
 - 7. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc.to meet job conditions.
 - 8. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
 - 9. Finishes: cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
 - 10. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.
 - 11. Manufacturer:
 - a. Cooper B-Line series BCH21 (max 32 CAT-6A cables), BCH32 (max 50 CAT-6A cables), BCH64 (max 72 CAT-6A cables).
 - b. Caddy/Erico cablecat.
 - c. Or approved equal.

PART 3 - EXECUTION

- 3.1 GENERAL
 - A. Comply with the Executive requirements of Section 27 05 00.

3.2 EXAMINATION

- A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Notify the University's Representative of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Installer is responsible for the integrity of the structures to which the system is attached, including their capability of safely accepting the loads imposed as evaluated by a qualified engineer.
- C. The University's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the University.

3.3 PREPARATION

- A. Prepare and maintain the following clearances from EMI sources (per BICSI Standards).
 - 1. Power cable (in grounded conduit) = 6 inches
 - 2. Power cable (unshielded) = 24 inches
 - 3. Fluorescent lights = 5 inches
 - 4. Transformers = 48 inches
- B. Provide all low voltage Communications Systems Pathways and Electronic Security and Safety System Pathways.

3.4 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS)

- A. The cabling support system shall be installed in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.
- B. Provide dedicated supports at sixty inches (60") separation, maximum, per a given route. Suspend wire or rod using components appropriate for the structure e.g., powder-actuated clip fastener for wire, beam flange clip or angled flange clip for either wire or rod, or an embedded anchor for the threaded rod. Do not share support (wire/rod) with other trades. Do not support the hanger on ceiling grid support wires. Do not support the hanger from ductwork, piping, or other equipment hangers.
- C. Provide independent pathways for each low voltage system (network, 800MHZ Radio, access control, DAS, BMS, etc.).
- D. Maintain minimum 6" clearance above suspended ceilings.
- E. Cable Tray cables are not to exceed a 25% fill when the project is complete. 25% fill is a visual fill of 50% of the cable tray.

3.5 CONDUIT

- A. Conduit used for pathway is to be designed with a maximum 40% visual fill.
- B. EZ path retrofit EZDR-400 or EZDR-200 will be provided on all conduits when required for compliance.

3.6 FLOOR BOXES AND POKE THROUGH DEVICES

A. All Floor boxes shall be sized and approved by UCD IT and FD&C's furniture group.

- 1. Wiremold RC9AM2TCBK flush poke -thru with accessories as required.
- 2. One 1-1/4" trade standard, data.
- 3. One 1-1/2" trade standard, av or other.
- 4. Floor poke through assembly, dual service feed-through fitting. Commonly used wire mold RC9AM2TCBK flush poke -thru with accessories as required. One 3/4" trade standard and one 1-1/4" trade standard.
- 5. Wiremold 4ffatcbs flush furniture feed poke -thru with accessories as required.
- 6. Or approved equal.

SECTION 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide telecommunications pathways in accordance with ANSI TIA-569-E, as shown on the plans or as designed by an RCDD.
- B. Provide conduits as required by fire code and where wall cavities are obstructed.
- C. Provide Ring and String where allowed in wall cavities and locations are accessible.
- D. Provide a minimum of a 1 $\frac{1}{4}$ " conduit for wall drops as needed.
- E. All junction boxes shall be sized and designed by a registered RCDD communications designer.
- F. Conduit for communications is NOT to adhere to the parallel of the exterior wall configuration required by the electrical specification. Cable Distance is priority for communications cabling and dictates path taken.

1.2 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- C. 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS SYSTEMS
- D. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Submittals are to be approved by IT Facilities Department and consultant.
 - 1. Obtain written approval from the Consultant for the product data submittal prior to materials and equipment purchase order and prior to installation.
 - 2. Format: Submit each product data as an electronic (PDF) document.
 - 3. Labeling: For each submittal, provide a cover page including the following information:
 - a. Client Name
 - b. Project Name and Address
 - c. Submittal Name (e.g., "Product Data Submittal for LCD Panel Backbox.")
 - d. Specification Section Number (e.g., "Section 27 05 33).
 - e. Date of Submittal
 - f. Contractor Name
- C. Submit conduit shop drawings for cable path other than wall drops.
- D. Confirm low voltage pathway quantity and fill ratio expected.

- E. Include junction box locations and sizes.
- PART 2 PRODUCTS
- 2.1 WORK AREA OUTLET BOX
 - A. Work area outlet box.
 - 1. 4 11/16" x 2 1/8" deep boxes on wall drops where required.
- 2.2 JUNCTION BOXES
 - A. Junction Boxes
 - 1. Sized to accommodate bend radius of cabling being installed.

2.3 FLOOR BOXES, POKE-THROUGHS AND MONUMENTS

- A. Floor Box, Flush Devices
 - 1. All Floor boxes shall be sized and approved by IT facilities and FD&C's furniture group.
 - 2. Manufacturers
 - a. Wiremold RC9AM2TCBK Flush Poke -Thru with accessories as required.
- B. Floor Poke Through Assembly, dual service feed-through fitting.
 - 1. Commonly used.
 - a. Wiremold RC9AM2TCBK Flush Poke -Thru with accessories as required.
 - 1) One 3/4" trade standard
 - 2) One 1-1/4" trade standard
 - b. Wiremold 4FFATCBS Flush Furniture Feed Poke -Thru with accessories as required.

2.4 WIRELESS, SECURITY AND OTHER PERIPHERAL CABLING INSTALLATIONS

- A. Conduit and/or electrical outlet box shall not be installed for wireless access point installations unless required by AHJ or physical conditions of the area.
- B. Consider the device being installed when calling out conduit and housings for security and peripheral devices due to differing requirements.

2.5 FIRE PENETRATIONS

A. EZ path retrofit EZDR-400 shall be provided where applicable as fire stop materials on all conduits.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Distribution Pathway via EMT Raceway:

- 1. Structured cabling installation is to meet BICSI cable distance limitations. Remaining parallel to the building structure is not a requirement.
- 2. All ends of conduits shall be cut square, reamed, and fitted with insulated bushing.
- 3. All conduit which passes through firewalls shall adhere to applicable fire code.

3.2 PREPARATION

- A. Fill ratios are to be calculated by the designer and installer during their respective design and installation phases of the project.
- B. Cable Tray cables are not to exceed a 25% fill when the project is complete. 25% fill is a visual fill of 50% of the cable tray.
- C. Conduit used for pathway is to be designed with a maximum 40% visual fill.
- D. EZ path retrofit EZDR-400 or EZDR-200 will be provided on all conduits when required for compliance.

3.3 MOUNTING AND INSTALLATION – WORK AREA OUTLET BOX

- A. Provide back boxes at all wall phones and employee time clocks.
- B. The distance between pull boxes shall not exceed 100 feet.
- C. Conduits exceeding two 90-degree bends shall be upsized to the next trade size and never exceed 240 degrees.
- D. Support and fasten pathway and pull boxes as defined in the electrical specifications.
- E. Conduit purposed for floor box(es) must have the respective conduit turn up in an adjacent or nearby wall or column that is stubbed to nearest accessible ceiling.
- F. Manufacturer's instructions:
 - 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
 - 2. Maintain jobsite file of Material Safety Data Sheets (MSDS) for each product delivered to jobsite packaged with an MSDS.

3.4 PENETRATIONS

- A. Provide EZ path fire penetrations where applicable.
- B. Provide conduit penetrations per electrical Specifications.

3.5 STATION CABLE PATHWAY INSTALLATION

- A. Work Area Outlet Boxes:
 - 1. Unless otherwise noted on the plans, all cut in boxes and surface station outlet boxes are to be installed at a height of 18" A.F.F. (above finished floor) to center, except for those otherwise called out.
 - 2. Those plates or boxes that are to be used for telephone wall jacks shall be installed according to ADA requirements.
 - 3. All cabling outlets shall be installed so that their edges are parallel to the vertical and horizontal edges of the surface on which they are mounted.

3.6 FINAL INSPECTION AND CERTIFICATION

- A. Punch Walks and Punch Lists
 - 1. Punching the Work of individual Sections of Division 27 may be combined.
 - 2. Execute a punch walk with the Consultant to observe work.
 - 3. Develop a punch list for items needing correction. Issue this punch list to Consultant.
 - 4. Correct the Work as noted on punch list.
 - 5. Execute follow up punch walk with the Engineer and the Owner or Owner's Representative to verify punch list items have been corrected.

SECTION 27 05 53 IDENTIFICATION AND LABELING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling for items including but not limited to communications cabling (structured and non-structured) innerduct, connectors, faceplates, jacks, receptacles, patch panels, and racks.
- B. All labels will be preprinted, or computer printed type. Handwritten labels are not acceptable.
- C. This section includes minimum labeling requirements for the following:
 - 1. Room designations
 - 2. Communications cabling
 - 3. Closet Hardware including patch panels, terminal blocks, protectors, and racks.
 - 4. Work Area Outlets
 - 5. Wireless Access Points
 - 6. Pathways and Spaces
 - 7. Grounding and Bonding
- 1.2 VISUAL APPEARANCE
 - A. Clear plastic covers over faceplate labels are not permitted.
 - B. Shall be preprinted or computer printed type, minimum 12pt. font.
 - C. Black SMBs are to be labeled with white on black.
 - D. Stainless will be labeled with black on white.
 - E. White (if required) will be labeled with black on white.

1.3 LABELING STANDARDS AND REQUIREMENTS

- A. All new labeling is to reflect UCD labeling standards.
- B. Contact the University's Representative for a copy of the current standards prior to proceeding.
- C. Bring to the University Representative's attention any project conditions not described in these specifications and the University's current standards and conform to the direction received.
- D. Identification and administration work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

1.4 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

D. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

PART 2 - PRODUCTS

- 2.1 COMMUNICATION CABLING LABELS, GENERAL
 - A. Shall meet the legibility, defacement, exposure, and adhesion requirements of UL 969.
 - B. Shall be preprinted or computer printed type, minimum 12pt. font. Handwritten labels are not acceptable.

2.2 COMMUNICATION CABLING LABELS, INTERIOR

- A. Provide vinyl substrate with a white printing area and black print.
- B. If cable jacket is white, provide cable label with printing area which is either orange or yellow, such that the labels are easily distinguishable.
- C. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.
- D. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.
- E. Manufacturers:
 - 1. Cable Type- 4 pair UTP /4 pair UTP Zero Skew Panduit S100X150VAC or approved equal.
 - 2. Cable Type- 4 pair STP Panduit S100X150VAC or approved equal.
 - 3. Cable Type- 25 to 100 pair copper Panduit S100X650VAC or approved equal.
 - 4. Cable Type- 2 strand fiber Panduit F100X300AJT or approved equal.
 - 5. Cable Type- 4-12 strand fiber Panduit S100X150VAC or approved equal.
 - 6. Cable Type- RG-6 and RG-59 Coax Panduit S100X150VAC or approved equal.
 - 7. Cable Bundles Panduit UIHL12-XO or approved equal.
 - 8. Other Interior Cabling Panduit S100X650VAC or approved equal.
- 2.3 GROUNDING AND BONDING, PATHWAY, AND SPACE LABELS A. Panduit C200X100FJC or approved equal.

2.4 WORKSTATION LABELS

- A. Panduit White C061X030FJC
- B. Panduit White C750X050YIJ or approved equal.

2.5 LOCATION NAMEPLATES

- A. Provide laminated plastic nameplates for each equipment enclosure, rack, switch, and device, as specified.
- B. Comply with ASTM D 709.
- C. Each nameplate inscription shall identify the function and, when applicable, the position.
- D. Nameplates shall be melamine plastic, 0.125-inch thick, black with white center core.

- E. Surface shall be matte finish. Corners shall be square.
- F. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by three inches.
- G. Lettering shall be a minimum of 0.25-inch-high normal block style for location nameplates or a minimum of 1-inch-high normal block style for rack nameplates.
- H. Panduit C300X100APT or approved equal.

2.6 COMMUNICATION CABLING LABELS, OUTSIDE PLANT

- A. Cable Tags in Manholes, Handholes, and Vaults
 - 1. Provide tags for communications cable or wire located in manholes, handholes, and vaults.
 - a. The tags shall be polyethylene.
 - b. Machine printed Do not provide handwritten letters.
 - 2. Polyethylene Cable Tags
 - a. Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch) 3250 pounds per square inch; and that are two millimeter (0.08 inch) 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C 170 degrees F. For fiber optic cables provide Panduit PST-FO or equal. For Copper cables provide Panduit PST-1028 or equal.
 - b. Provide a one-piece nylon, self-locking tie for cable tags.
 - c. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds) 175 pounds. The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) one inch high on a yellow background.
 - d. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.
 - 3. Manufacturers:
 - a. Panduit
 - b. Brady
 - c. Or equal.

PART 3 - EXECUTION

- 3.1 GENERAL
 - A. Verify all room numbers, racks, conduits, cable tray, cables, equipment housing, vaults and items within this document have been labeled.
 - B. Contractor applied labeling shall reflect final space and Telecommunications structure designations.
 - C. Accurate labeling shall be provided on the as-built shop drawing submittals.

3.2 IDENTIFICATION AND LABELING

A. Telecommunications Rooms

- 1. Labels shall be affixed at the entry to all telecommunications rooms and spaces (Includes entrance facilities, telecommunications equipment rooms, communication equipment spaces and work areas).
- 2. All IT rooms are numbered but not designated "equipment" due to security concerns.
- B. Cable Tray and Conduits
 - 1. Cable tray structured versus AV or analog systems pathway labeling and designations are the responsibility of the installer to designate the services that are to use the pathway or what portion of the pathway.
 - 2. Any permanent label that is clearly visible is acceptable.
- C. Rack and Cabinet Labeling
 - 1. Provide laminated plastic nameplates for each equipment enclosure, row and rack designations as shown on elevations provided by UCD IT.
- D. Copper Patch Panels Horizontal
 - 1. Label with Jack numbers.
- E. Tie Cable Patch Panels
 - 1. Label the pair count at the top of the patch panel, separated from all others.
 - 2. Place the cable's identification text centered on the top label strip. (example:18CA75, TIE 1672A).
- F. 110 Blocks
 - 1. Not used other than MPOE, OSP installation.
 - 2. Label with University provided designation.
- G. Workstations
 - 1. Use adhesive type labels and affix labels to faceplate per diagram provided.
 - 2. Provide sequential 4 or (Occasionally 5 digit) jack number (starting dependent on the floor designation) beginning with an X such as X056, X being floor# followed by the closet sequenced cable number. All faceplate labels shall contain the following items:
 - a. Building and Closet Designation such as 34-1100 (building#, IT closet#)
 - b. TR Designation such as TR1.1 or TR 1A (University established designation)
 - 3. Under no circumstances are jacks to be installed with a drop/name or location number as a label or a matrix identifier.
 - 4. See diagrams below:





- H. Wireless Access Point (WAP) Labeling
 - 1. The University's Representative will provide locations for Wireless Access Point installations with the University's assigned designated identifiers adhered to the Access Point itself.
 - 2. Building Designation / room or area designation AP / a, b, c (if multiple APs within room).
 - 3. WAP labeling consists of the Icon being a designated color at the device, Icon being a designated color in the patch panel, and a band being installed on both ends of the patch cord that connects the cable in the TR room.

- I. Grounding and Bonding
 - 1. Label the TMGB (telecommunications main ground busbar) with an adhesive label.
 - 2. Label the TGB(s) (telecommunications ground busbar) with an adhesive type of label(s).
- J. Other Cable Numbering
 - 1. Other cabling types, such as Coax installed in a TR shall be numbered uniquely, such as C=Coax.
 - 2. Cameras and APs are Data Cabling, which falls into the Data Cabling labeling scheme.
 - 3. Point to point Data Cables require independent numbering such as A1001 for items such as in room video distribution such as N-stream equipment.
- K. Fiber Patch Panels
 - 1. Fiber patch panels shall be marked using adhesive labels indicating the range of circuits installed to it. All fiber optic cable patch panels shall be labeled with the pair count of every fiber pair, the cable's assigned identifier, and the patch panel's assigned identifier.
 - 2. Coordinate with IT before applying any labels.
 - 3. All labels shall consist of the following:



FIBER OPTIC INTERBUILDING (between buildings) LABELING CONVENTION

Example:

Origination (from): Label begins with fiber cable designation (fiber identifier such as F329) - followed by the building number (57) - room number (2019) - row & rack locations (R1R2) - fiber termination panel ID (A) - fiber count (697-708)

Destination (to): Label begins with fiber cable designation (fiber identifier such as F329) - followed by the building number (57) - room number (2019) - row & rack locations (R1R2) - fiber termination panel ID (A) - fiber count (697-708)

"From" and "To" will be reversed at the destination end.

FIBER OPTIC INTRABUILDING (within building) LABELING CONVENTION



Example:

Origination (from): Label begins with fiber cable designation (IFA=UCDH campus, IFB=off campus location) followed by the building number (108) - intra-building cable number (01) - room number (1310) row & rack locations (R1R2) - fiber termination panel ID (A) - fiber count (01-48) Destination (to): Label begins with fiber cable designation (IFA=UCDH campus, IFB=off campus location) followed by the building number (108) - intra-building cable number (01) - room number (1401) - row & rack locations (R1R2) - fiber termination panel ID (A) - fiber count (01-48)

"From" and "To" will be reversed at the destination end.

- L. Fire stopping.
 - 1. Each fire stopping location shall be labeled at each location where fire stopping is installed, on each side of the penetrated fire barrier, within 12 in. of the fire stopping material.
 - 2. Labels shall adhere to the requirements set forth by the authority having jurisdiction (AHJ).
- M. Indoor Communications Cables

- 1. Horizontal and Indoor Backbone cables shall be marked within 12 inches of each endpoint or to innerduct in which the cable is installed.
- 2. Label each end of each riser cable where the cable terminates.
- 3. Backbone cables shall be marked at each endpoint and at all intermediate locations, pull/access point, or junction boxes through which the cable passes, as well as on each floor and in each room the cable is openly visible in.
- N. Copper Riser Cabling.
 - 1. Label all copper backbone cables of at least 25 pair construction to contain the following information:
 - a. Installation Date
 - b. University Assigned Cable ID: (Example: 70 Tie 0P609).
- O. Fiber Riser cabling.
 - 1. Label all fiber backbone cables to contain the following information:
 - a. Installation Date
 - b. University Assigned cable ID:(Example: IFA134)

SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provisioning, installation, termination, and testing of twisted pair, horizontal cabling in modular furniture and hard wall workstations located throughout the project area. Work under this section will include:
 - 1. Wireless Access Point cabling
 - 2. Printer Stations
 - 3. IP Camera Cabling
 - 4. Monitor and CATV cabling.
 - 5. IP Medical Equipment in Exam Rooms
 - 6. All workstation cabling as defined on the construction documents.

1.2 TYPICAL WORK AREA OUTLETS

- A. A typical work area outlet (per chair) or (Drop) shall consist of two (2) (Purple end to end) Category 6A Data cables, unless otherwise indicated.
 - 1. When re-cabling a building or office consideration shall be made to add Data Cables to support devices that will continue to be viable after a transition to a VoIP network such as fax machines, fire alarms, elevator phones, pay phones etc.
- B. A typical work area outlet shall have a slack loop of 10 feet at the field end of the run.

1.3 OTHER OUTLET CONFIGURATIONS

- A. Wireless Access Points
 - 1. A typical wireless access point (WAP) Outlet shall consist of two (2) (Purple end to end) Category 6A Data cables, unless otherwise indicated.
- B. Timeclock Outlet
 - 1. A typical time cock outlet shall consist of one (1) (Purple end to end) Category 6A Data cable, unless otherwise indicated.
- C. Other outlet configurations as defined by and coordinated with Owner IT.
- D. All Outlet types listed above shall have a slack loop of 10 feet at the field end of the run.
- 1.4 RELATED SECTIONS
 - A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
 - B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
 - C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
 - D. 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS SYSTEMS

PART 2 - PRODUCTS

- 2.1 MODULAR JACK COMPONENTS, GENERAL
 - A. Modular Jacks rated Category 6A.
 - 1. Panduit Mini-Com CJ6X88TGVL.
 - 2. Colored Icons as needed per UCDM service designation.
 - 3. Panduit PAN_CID(XX).
- 2.2 COPPER CABLING, CATEGORY 6A
 - A. High Speed, TIA category 6A Cabling, Plenum Rated
 - 1. General Cable GenSpeed 6A Part No. 7151855 Purple.
- 2.3 TELECOMMUNICATIONS OUTLET COMPONENTS
 - A. Modular Furniture Surface Mount Box, Black
 - 1. Panduit CBXQxBL-A Where x = number of ports
 - 2. Modular Surface Mount Box Attachment System Mini-Com CBM-X
 - 3. Modular Surface Mount Box Blank Insert Panduit CMB(BL)
 - B. Faceplate
 - 1. Panduit- Mini-Com Faceplates (CFP (2,4,6) SY I CFP (4,8,10) S-2GY
 - 2. Coordinate finish with Architect prior to submittals.
 - C. Faceplate Blank Insert
 - 1. Panduit CMB(WH)
 - D. One Hole Wall Plate
 - 1. Leviton 84004-40 Stainless where requested.
 - 2. Leviton 80720-W White where requested.
 - 3. Coordinate finish with Architect prior to submittals.
 - E. Black Loom
 - 1. Panduit loom CLT100F/CLT150F (choose size appropriate for cable installation quantity)
 - 2. Thomas & Betts black liquid tight EFC150
 - F. Duplex In-Line Jack frame, one to four jacks (only where required, NOT standard installation)
 - 1. Panduit Mini-Com 106 Duplex Module Frame

PART 3 - EXECUTION

- 3.1 CABLING RUN LENGTHS
 - A. Distance limitation of the in-wall cabling shall be thoroughly reviewed and calculated to be less than 275' when including the anticipated plug pack cabling length in the telecommunications room (TR).

- B. Contractor to field verify the performance including cable length of the proposed installation in a mockup using the proposed cabling, jacks, raceway, and test equipment prior to proceeding.
 - 1. Locate proposed cable pathway drawing for the upcoming cable run.
 - 2. Contractor to install One (1) typical copper work area outlet complete with jacks at both ends.
 - 3. Use the proposed pathway and cabling to the furthest location from the TR.
 - 4. Install a cable simulating the cable length of the Plug Pack configuration.
 - 5. The cabling contractor is to perform testing of these cables patched together to determine the true length of this mockup.
 - 6. Test Results are to be inspected and reviewed by the University's Representative prior to proceeding with the rest of the installation.
 - 7. Any deficiencies in the installation of the mockup are to be corrected by the Contractor and re-inspected by the University's Representative prior to proceeding with the rest of the installation.
- 3.2 MODULAR JACK COMPONENTS
 - A. Category 6A Data Jacks performance shall meet requirements as defined in TIA standards.
 - B. Follow manufacture's Installation procedures.

3.3 TELECOMMUNICATIONS OUTLET EXECUTION

- A. Modular Furniture Surface Mount Box, One to Four Jacks
 - 1. Surface mount box magnetically attached to furniture.
 - 2. Removing knockouts in the base of the furniture shall be avoided.
- B. Telecommunications Outlets. New, Copper Jacks, Wall Mount, Flush Mount Assembly.
 - 1. Complete outlet assembly, including but not limited to:
 - 2. Faceplate with manufacturer's standard jack openings
 - 3. Blank connector modules at faceplate openings not filled with connector modules.
 - 4. Features: Single gang with openings for the required number of cables. Provide flat stainless steel.
 - 5. Features: Double gang with openings for the required number of cables. Provide flat stainless steel.
- C. Voice Telephone Station Plates and Jacks (special provision)
 - 1. Wall Mounted Analog Telephone
 - 2. Wall mounted IP Telephone Station
 - 3. Single outlet wall plate w8P8C data Jack

3.4 COPPER CABLING DATA VOICE/DISTRIBUTION

- A. Maintain the following clearances from EMI sources (Per BICSI Standards)
 - 1. Power cable 6 in.
 - 2. Fluorescent Lights 12 in.
 - 3. Transformers- 48 in.
- B. Monitor cable length limitations.

- 1. All cable installations shall be continuous, un-spliced runs.
- 2. All wiring above ceilings shall be installed in cable tray or cable hangers.
- 3. Cable in accessible ceilings shall be supported 5' on center (min) attached to building structure.
- 4. Cable shall have no physical defects such as cuts, tears, or bulges in the outer jacket.
- 5. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.
- 6. Limit cable bends to a minimum radius of 4 times cable diameter except where otherwise noted herein.
- 7. Refrain from exceeding fill ratio on horizontal cabling installations.
- 8. Do not put large sweeps or service loops in vertical wire managers.
- 9. Provide slack, which is to be no less than 2.5" and no greater than 5.0", in the station cable at the station outlet end. The Work Area Outlet shall provide enough slack to be serviceable without excess.
- 10. Service loop at outlet locations: Provide a (10') Ten Foot Slack Loop for all horizontal cabling, supported on J-hook with wire above all drop locations.
- 11. All data and voice station cable shall be terminated at the individual receptacle modules in accordance with ANSI/TIA-568-C, assignment T568B.

3.5 TESTING

- A. All system cabling and terminations shall be installed in accordance with manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.
- B. Installation shall be performed and accomplished in a professional manner, by qualified personnel.

3.6 PERFORMANCE STANDARDS

- A. Horizontal (Station) category 6A Copper cabling Permanent Link
 - 1. Testing shall commence while the University's equipment in the area of service is operational and creating worst case emissions associated with its operation while in good working order. Every effort shall be made to include worst case influence on the materials installed shall be taken.
 - 2. In accordance with the field test specifications defined in TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard", every horizontal station cabling link in the project shall be tested for:
 - a. Wire Map Length Insertion Loss NEXT Loss
 - b. PS NEXT Loss
 - c. ACR-F Loss
 - d. PS ACR-F Loss
 - e. Return Loss
 - f. Propagation Delay
 - g. Delay Skew
- B. Using the listed category 6A cable test set, test installed cabling using Permanent Link procedure and submit report demonstrating that the link meets the following:

- 1. Each permanent link shall demonstrate a positive PSACR beyond 350 MHz to meet and exceed the bandwidth requirements of TIA-568-C.2 Category 6A standards.
- Each permanent link shall demonstrate 2 dB of cross talk headroom over TIA -568-C.2 Category 6A standard for NEXT, PSNEXT, ELFEXT and PSELFEXT bit error rate.
- 3. Report whether tested link passes or fails.
- 4. Note exceptions to required Category standards. Remedy and retest.
- 5. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications room wiring.
- 6. Test each end-to-end cable link.
- 7. Submit machine-generated documentation and raw data of all test results on Contractor- provided, and University's Representative approved, forms; and in electronic format approved by the University's Representative.
- 8. Test stations wire only after all pairs of station wire in a work area have been terminated at both ends, and no work of this Section or other Sections may cause physical disturbance to the wiring.
- 9. Correct any and all transpositions found. Retest.
- 10. If any conductor in a station wire tests either open or short, then the entire station wire is to be removed, replaced, and re-tested.
- 11. The Contractor shall test all cables and submit all horizontal copper cable test result data in electronic format, with the resulting file formatted with one test result per 8.5"x 11" page. Export or Download the test results from the cable tester for submission in native format.
- 12. Data found to be altered from the manufacturers recommended settings may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
- 13. Events exceeding industry standards will cause the test result to be rejected. Direct review by UCD IT will be required to allow for an exception of a test result.
- 14. Data found to be incomplete may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
- 15. Contractor shall submit (1) copy of software capable of viewing the electronic test result files. Testing Results shall be reviewed and verified by the University before payments are remitted.
- C. Test Equipment
 - 1. Contractor shall provide all test equipment as required to perform the scope of work.
 - 2. Test the communication systems cabling using at least one (1) each of the following test measurement devices or their functional equivalents:
 - a. Level IIIe field testers as defined in TIA-1152 Fluke DSX-5000, or equal.
 - b. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of TIA-1152
 - c. The RJ45 test plug shall fall within the values specified in TIA-568-C Annex C for NEXT, FEXT and Return Loss.

- d. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.
- e. In order to deliver optimum accuracy, permanent link interface adapter for the tester shall be used, which can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface.
- f. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor.
- g. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.
- h. Site portable communications systems (walkie-talkie, cell phone, or similar to aid in communications between test device locations)