SPECIFICATIONS

For

Project #9557960
Building 73 CUP Repair Steam Condensate System Supports

UC Davis Health
Sacramento, Ca

Weston & Associates Mechanical Engineers
601 University Ave Suite 260
Sacramento, Ca 95825

REVIEWED IN ACCORDANCE WITH
THE REQUIREMENTS OF T24, CCR
APPROVED
S241919-34-00
Tony Tan, Sr. Architect
Apr 07, 2025
Department of Health Care Access and Information
Office of Statewide Hospital Planning & Development

HCAI #S2419191-34-00

December 2024

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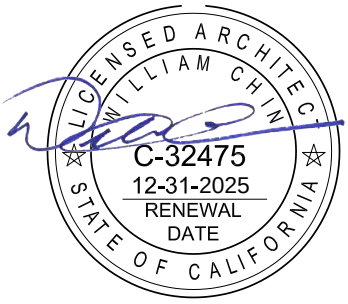
ARCHITECTURAL



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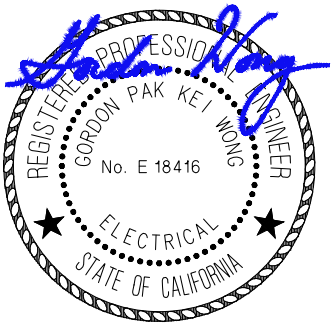

STRUCTURAL

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DIVISION 1 – GENERAL REQUIREMENTS
TABLE OF CONTENTS

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SECTION 01 11 00

SUMMARY OF THE WORK

PART I - GENERAL

1.01 SECTION INCLUDES

A. Description of the Work

B. Contractor Warrants

C. Contract Document Intent and Relationships

D. University Furnished/Contractor Installed Products

E. University Furnished/University Installed Products

F. Concurrent Work Under Separate Contracts

G. Site Condition Survey and Protection of Existing Improvements

H. Contractor Use of Site and Premises

I. University Beneficial Occupancy (if applicable)

J. Project Phasing (if applicable)

1.02 DESCRIPTION OF THE WORK

A. Project is titled: CENTRAL PLANT REPAIR STEAM CONDENSATE SYSTEM SUPPORTS

B. University Project No.: 9557960

C. Project is located at 4840 2nd Ave. , Sacramento, CA., 95817, UC Davis Health, Sacramento, California, as shown on the vicinity map.

D. Project is an infrastructure repair of the Central Plant (Bldg 73) steam condensate system. Work focuses on the steam condensate piping between the condensate receiver and return pumps in the basement, and the deaerator tank on the first floor. The condensate return line between the condensate receiver and the deaerator is unsupported and vibrates during operation. Additionally, this project consists of retrofitting the condensate return pumps as well as the medium pressure boiler feed water pumps with Variable Frequency Drives (V.F.D.). This project also includes the installation of additional floor drains, gas flow meters, steam condensate flow meters, and the rerouting of existing piping to improve equipment maintenance and operability.

A description of areas, types of construction and general nature of the Work are described on drawing (G0.01). Project will require the contractor to work in and around occupied facilities. Contractor will need to work off-hours to accommodate the equipment retrofit and existing piping reroutes at no additional cost to the owner.

E. 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. There are no UFCI products furnished by the University.

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. There are no UFUI products furnished by the University.

B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to provide all rough-in requirements into the Work, including as necessary but not limited to fasteners, backing, supports, piping, conduit, conductors and other such provisions from point of service to point of connection, and field finishing, as shown on the Drawings and/or specified herein. See Section 013100 - COORDINATION for additional requirements.

1.07 CONCURRENT WORK UNDER SEPARATE CONTRACTS - NOT USED

~~Use this sub-Section only when conducting the build-out with separate contractors, such as Multiple Primes. Other examples of situations requiring this approach: Plant Operations & Maintenance (PO&M) to install~~

casework they have built. IT department to install cabling, panelboards, etc. for its systems during the construction period.

A. Work Under Separate Contracts: University will award separate contracts for the following work and other work as may be indicated on the Drawings as NIC (Not in Contract), including the following:

1. Test and balance work.

2. HVAC digital control work.

3. [List specific work by others.]

B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to make such concurrent work under separate contracts complete in every respect and fully functional, including field finishing. Provide necessary backing, supports, piping, conduit, conductors, and other such provisions from point of service to point of connection for additional requirements.

C. Related Contract Documents: University will make available, in a timely manner, Contract Documents of work under separate contracts for coordination and further description of that work. Such drawings and other data required for the coordination of the work of separate contracts with the Work of this Contract may be included with the Contract Documents. If so, they are provided for convenience only and are not to be considered Contract Documents.

1.08 SITE CONDITION SURVEY & PROTECTION OF EXISTING IMPROVEMENTS - NOT USED

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 3:00 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 twenty-one (21) calendar days' notice of Full utility outages and shutdowns. Provide fourteen (14) calendar days' notice for Partial shutdowns.

1.10 UNIVERSITY BENEFICIAL OCCUPANCY – NOT USED

1.11 PROJECT PHASING - NOT USED

~~A. The WORK OF THIS contract is divided into [ ] Phases.~~

~~1. The Work of Phase I consists of:~~

~~Coordinate Phasing with Section 013200 – CONTRACT SCHEDULES. Different phases can overlap or be performed concurrently. Do not use dates (other than or site access); always use calendar days when stating time. Provide the following:~~
~~Describe the specific work of each Phase.~~
~~Establish the number of calendar days to complete the work of each Phase.~~
~~Establish the number of calendar days separating each Phase of the Work (if applicable).~~
~~Establish if one Phase must be completed before the next Phase can begin.~~
~~Define any Liquidated Damages (LD) for each Phase. LDs tied to each Phase of the Work may be used to encourage Contractors to complete the work at the required times.~~
~~Portions of this information will also appear in the Advertisement for Bid, Supplementary Instructions to Bidders and the Bid Form.~~

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not applicable to this Section

END OF SECTION 01 11 00

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SECTION 01 14 00

WORK RESTRICTIONS

PART I - GENERAL

1.01 WORK HOURS

A. No Work shall be done outside of standard Monday through Friday 7:00 a.m. to 3:00 p.m. working hours, on holidays or weekends unless prior written approval has been retained from the University's Representative.

1.02 PROJECT PHASING - NOT USED

1.03 WORK SEQUENCE and WORK RESTRICTIONS

a. Central Plant must always remain operational. Refer to 11 11 00 1.02E. Any work that will impact the path of travel or building utilities must be approved by the University's Representative. Any work that will impact the path of travel or building utilities must be approved by the University's Representative. Contractors can work unescorted inside the Central Plant once they have reviewed/acknowledged UCDH' policy for unescorted contractors, but will be required to sign in and sign out whenever entering or leaving the facility. In and out should be limited. Contractors will need to be buzzed in everyday; badge access is not available.

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 - NOT USED

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 always taken while 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 7:00 a.m. and after 3:00 p.m. and weekend Work, at no additional cost to the University. At least 21 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. Utility Shutdowns may require weekend, evening, and overtime. Refer to 11 11 00 1.09 D.

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 controls and the work activities to be performed. The design, selection, and placement of traffic control devices for the traffic control plan shall be based on engineering judgment and in accordance with

Part 6 of the California Manual on Uniform Traffic Control Devices for Streets and Highways.

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

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SECTION 01 25 00

CLARIFICATION/INFORMATION PROCEDURES

PART I - GENERAL

1.01 DESCRIPTION

A. This Section contains the procedures to be followed by **Contractor** for submitting a Request for Information (RFI) upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or Drawings or upon having any question concerning interpretation.

B. Section Includes

1. RFI Administrative requirements

2. RFI Procedures

3. RFI Execution

1.02 RELATED DOCUMENT SECTIONS

A. Conditions of the Contract: Governing requirements for changes in the Work, in Contract Sum and Contract Time.

B. Section 016100 – PRODUCT REQUIREMENTS: Product options, substitutions, omissions, and improper descriptions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Description: Section provides procedure for Contractors to obtain interpretation or clarification of the Contract Documents, or identify apparent conflicts, omissions, or errors in the Contract Documents.

B. Responsible Person for **Contractor**: Submit name of the individual authorized to receive Requests for Information documents, and who is responsible for forwarding Request.

C. RFI Format: Submit all Requests for Information on the form attached at the back of this Section, or electronic and/or web-based construction administration software provided or accepted by the University.

1.04 RFI PROCEDURES

A. RFI Format, Numbering and Subject:

1. RFI Format: Submit all requests for clarification or additional information in writing to University's Representative using the RFI Request for Information form provided at the back of this Section or obtained from University's Representative.

2. RFI Numbering: Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix for resubmissions. For example, the first RFI is numbered

"001". The second RFI is numbered "002" and so on. The first resubmittal of RFI "002" will be numbered "002a".

3. RFI Subject: Limit each RFI to one (1) subject only.

B. RFI Submittal conditions:

1. Discovery of unforeseen condition or circumstance not described in the Contract Documents.

2. Discovery of an apparent conflict, discrepancy, or inconsistency in or between portions of the Contract Documents.

3. Discovery of a situation, direction or apparent omission that cannot be reasonably inferred from the intent of the Contract Documents.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 EXECUTION OF RFI's

A. Email the University's Representative the RFIs. Emailed RFI requests received after normal business hours and/or received on non-normal workdays, as defined in Specification Section 013100–COORDINATION, Item 1.07.F.4.A will begin notification time starting at 7:00 a.m. the following workday.

B. Failure to provide proper information: RFIs will not be recognized or accepted if, in the opinion of University's Representative, one of the following conditions exist:

1. **Contractor** submits the RFI as a request for substitution.

2. **Contractor** submits the RFI as a Submittal.

3. **Contractor** submits the RFI as a Contract Document discrepancy or omission without through review of the Documents (Capricious submission).

4. **Contractor** submits the RFI assuming portions of the Contract Documents are excluded or by taking an isolated portion of the Contract Document in part rather than in whole.

5. **Contractor** submits the RFI in an untimely manner without proper coordination and scheduling of Work of other Trades.

C. Response Time: Request clarifications or information immediately upon discovery of need. Submit RFI's in a timely manner allowing full response time to avoid impacting Contract Schedule.

1. University's Representative, whose decision will be final, shall resolve issues and respond to questions of **Contractor**, in most cases, within fourteen (14) calendar days. Actual time may be lengthened for complex issues, or shortened for expedited situations, as mutually agreed in writing.

2. After submission of an RFI by **Contractor** and prior to receipt of the RFI response from University, the **Contractor** proceeds with effected Work at own risk. Any

portion of the Work not constructed in accordance with University'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

Project #: _____ **Project Title:** _____

RFI #: _____ **Date:** _____ **HCAI #:** _____

UC Davis Health Facilities Design & Construction 4800 2nd Avenue, Suite 3010, Sacramento, CA 95817 **Attn.: Michael Gomez** C: 916-707-3632 Email: mhgomez@ucdavis.edu	From:	

SUBJECT: _____

SPEC SECTION/DRAWING #: _____ **PARA:** _____ **DETAIL:** _____

RM # _____ **GRID #** _____

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

INFORMATION NEEDED: _____

CONTRACTOR'S PROPOSED RESOLUTION: _____

REQUESTOR SIGNATURE: _____ **REPLY REQUIRED BY:** _____

☐ **ATTACHMENTS:** _____

REPLY: _____

REPONDER SIGNATURE: _____ **DATE:** _____

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

COPIES: ☐**University** ☐ **CONSULTANTS** ☐_____ ☐_____ ☐_____ ☐ **FILE**

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SECTION 01 25 50

CONTRACT MODIFICATION PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Change Order Administrative Requirements

B. Documentation of Change in Contract Sum and Contract Time

C. Change Procedures

D. Field Orders

E. Stipulated Sum Change Orders

F. Unit Price Change Orders

G. Time and Material Change Orders

H. Cost Proposals and Supporting Documentation

I. Execution of Change Orders

J. Reconciliation of Change Orders

1.02 RELATED DOCUMENT SECTIONS

A. General Conditions of the Contract: Governing requirements for changes in the Work, in Contract Sum and Contract Time.

B. Section 012500 – CLARIFICATION/INFORMATION PROCEDURES

C. Section 012900 – MEASUREMENT AND PAYMENT: Applications for Payment.

D. Section 016100 – PRODUCT REQUIREMENTS: Product options, substitutions, omissions, and improper descriptions.

E. Section 017700 – CLOSEOUT PROCEDURES: Project record documents.

1.03 DEFINITIONS

A. Total Wage Rate: Base rate paid to the worker, including his/her fringe benefits, workman's compensation insurance and subsequent payroll taxes paid by the employer.

1. Use Wage Rate Calculator issued with Division One.

2. Projects in the University Controlled Insurance Program (UCIP) should not include workman's compensation in the wage rates.

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

C. Non-working Supervision: Non-working supervision is not allowed to be included on a change order per GC article 7.3.3.

1.04 SUBMITTALS

A. Submit the items listed below prior to submitting the 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

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SECTION 01 29 00

MEASUREMENT AND PAYMENT

PART I - 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.

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. Media-driven 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.

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.

1) At 50 percent completion of the work, or at other times the University’s Representative deems appropriate, the University’s Representative may request the monthly amount of overhead and profit be adjusted, if the contract schedule indicates going beyond the Contract End Date.

d. For items on which payments will be requested for on-site stored products, list sub-values for cost of on-site stored products with taxes paid. If stored products are not on-site, they must be stored in a bonded warehouse or location approved by the University’s Representative prior to including on the Application for Payment.

e. Submit a sub-schedule for each separate Phase of Work specified in Section 011100. Include scheduling of sequences within each phase indicated on the drawings.

f. The Sum of values listed shall equal total Contract Sum.

g. When University's Representative requires substantiating information, submit data justifying line-item amounts in question.

h. Provide one (1) PDF electronic file of data with cover letter for each copy of Application. Show Application number and date, and line item by number and description.

4. Submit Applications for Payment, Continuation Sheets and Schedule of Values under PDF electronic transmittal letter. Contractor 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

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SECTION 01 31 00

COORDINATION

PART I - GENERAL

1.01 SECTION INCLUDES

A. Project Meetings

B. Submittals Requirements

C. General Contractor Coordination

D. Coordination of Subcontractor and Separate Contracts

E. University Criteria

1.02 RELATED REQUIREMENTS

A. Section 011100 – SUMMARY OF THE WORK: Description of Contract Documents.

B. Section 013200 – CONTRACT SCHEDULES

C. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

D. Section 013500 – SPECIAL PROCEDURES: Interim Life Safety Measures (ILSM).

E. Section 014500 – QUALITY CONTROL

F. Section 014550 – INSPECTION AND TESTING OF WORK

G. Section 015100 – TEMPORARY UTILITIES

H. Section 015200 – CONSTRUCTION FACILITIES

I. Section 015500 – VEHICULAR ACCESS AND PARKING: Traffic Regulation.

J. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS

K. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

L. Section 016100 – PRODUCT REQUIREMENTS

M. Section 017300 – CUTTING AND PATCHING

N. Section 017700 – CLOSEOUT PROCEDURES: Coordination of completion reviews, inspections, and submission of documents.

O. Section 017800 – CLOSEOUT SUBMITTALS: As-Built Documents.

P. Division 21 - Fire Protection Systems.

Q. Division 28 - Fire Alarm Systems

1.03 MEETINGS

A. Pre-Construction/Site Mobilization Conference: University's Representative will administer site mobilization conference at Project site for clarification of responsibilities of University, University's Representation and Contractor, use of site and for review of administrative procedures. Site mobilization conference shall be held within fourteen (14) calendar days of Notice to Proceed, unless otherwise directed by University's Representative.

1. Agenda: Pre-Construction/Site Mobilization Conference shall cover the following topics at a minimum:

a. Special Project Procedures: Implementation of requirements as specified in Section 013100 – COORDINATION.

b. Subcontractors List: Provide PDF electronic file. Distribute and discuss list of subcontractors and suppliers.

c. Construction Schedule: Provide per Section 013200. Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work, including coordination of University furnished/ Contractor installed (UFCI) products, University furnished/University installed (UFUI) products, and work under separate contracts, by utility agencies and companies and University.

d. Designation of Key personnel: Designate key personnel and update project directory for University, University's Consultants, Contractor, major subcontractors, major materials suppliers, serving utility agencies and

companies, other contractors performing work under separate contracts and governing authorities having jurisdiction.

e. Project Communication Procedures: Review requirements and administrative requirements for written, electronic and oral communications.

f. Change Procedures: Review requirements and administrative procedures for Change Orders, Field Orders, University's Representative's Supplemental Instructions, and Contractor's Requests for Information.

g. Coordination: Review requirements for Contractor's coordination of Work; review sequence and schedule for work being performed for University under separate contracts.

h. Submittals Administration: Provide per Section 013300 and Section 016100. Review administrative procedures for shop drawings, project data and sample submittals and review of preliminary submittals schedule.

i. Project As-Built Documents: Provide per Section 017700 and Section 017800. Review requirements and procedures for project as-builts, specifications and other documents.

j. Construction Facilities and Temporary Utilities: Provide per Section 015100 and Section 015200. Designate storage and staging areas, construction office areas; review temporary utility provisions; review University requirements for use of premises.

k. Materials and Equipment: Review substitution requirements; review schedule for major equipment purchases and deliveries; review materials and equipment to be provided by University (UFCI and UFUI products).

l. Site Access by University's Representative and University's Consultants: Review requirements and administrative procedures Contractor may institute for identification and reporting purposes.

m. Testing and Inspection: Provide per Section 014550 and other sections of the Contract. Review tests and inspections by independent testing and inspection agencies, manufacturers, and governing authorities having jurisdiction.

n. Permits and Fees: Review Contract requirements; review schedule and process for obtaining permits and paying fees.

o. Hours of Work and Work Restrictions per Section 011400.

p. Hot Works Permit.

B. Billing Meetings: A billing meeting will be conducted by the University's Representative each month prior to submittal of the Application for Payment. Agenda: review of the percent complete relating to the submitted Schedule of Values. Prior to the Billing Meeting the

Contractor will submit a draft of the Application for Payment for review by the IOR and University Representative.

C. Progress Meetings: Progress meetings shall be periodically scheduled throughout progress of the Work. Frequency shall be as determined necessary for progress of Work. Generally, it is intended progress meetings be held once a week as designated by the University's Representative.

1. Administration: University's Representative shall make physical arrangements for meetings and prepare agenda with copies for participants, preside at meetings, record minutes and distribute an electronic file within four (4) workdays to Contractor University's Consultants, and other participants affected by decisions made at meetings.

2. Attendance: Contractor's Project Manager and jobsite Superintendent shall attend each meeting. Contractor's subcontractors and suppliers may attend as appropriate to subject under discussion. University will have a representative at each meeting. University's Consultants, as appropriate to agenda topics for each meeting and as provided in University/Consultant Agreement, will also attend.

a. Suggested Agenda for Progress Meetings:

1) Building Code/Fire Marshal Issues

2) Design Issues

3) Submittals and Long Lead Items

4) UFCI and UFUI products.

5) Request for Information

6) Safety Issues

7) Scheduling Status/1 Week Prior and 3~~2~~ Week Look Ahead

8) Potential Schedule Delay Issues

9) Incomplete or Non-Conforming Work

10) Inspection Requests

11) Utility Shutdowns and Dig Notifications

12) Instructional Bulletins and Field Orders

13) Change Orders/Cost Proposals

14) Payment Applications and As-Built Documents

15) Miscellaneous Business

16) Other items affecting progress of the Work

D. Guarantees, Bonds, Service and Maintenance Contracts Review Meeting: Eleven months following the date of Substantial Completion, a meeting will be conducted by University's Representative to review the guarantees, bonds and service and maintenance contracts for materials and equipment.

E. In addition to meetings listed above, Contractor shall hold coordination meetings and pre-installation conferences to assure proper coordination of Work.

1. Pre-installation Conferences: When required in individual Specification Sections, convene a pre-installation conference prior to commencing Work.

a. Require attendance by representatives of firms whose activities directly affect or are affected by the Work specified.

b. Review conditions of installation, preparation and installation procedures and coordination with related Work and Work under separate contracts.

F. Location of all meetings will be as designated by University's Representative. Participants at all meetings shall be University's Representatives, Consultants and/or Vendors, Contractor, Superintendent, Subcontractors, and others as appropriate.

1.04 SUBMITTALS

A. Coordination of Submittals: Schedule and coordinate submittals as specified in Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, Section 017700 – CLOSEOUT PROCEDURES and Section 017800 – CLOSEOUT SUBMITTALS.

1. Coordinate submittal effort of various trades, subcontractors and suppliers having interdependent responsibilities for installing, connecting, and placing into service such equipment, materials or installations as necessary for the Work.

2. Coordinate requests for substitutions to assure compatibility of space, operating elements, and effect on work of others.

~~3. Contractor shall submit the following submittals to the University's Representative who will forward directly to the appropriate State Agencies for their review and approval:~~

~~a. Fire Protection Drawings: Refer to Division 21~~

~~b. Fire Alarm System: Refer to Division 28~~

~~c. Additional HCAI Deferred Approvals: Refer to list of deferred approvals as shown on the Contract Documents.~~

B. Coordination/Engineering Drawings: Submit in accordance with Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES and as specified herein.

C. Work Plans: Submit as specified herein.

1.05 COORDINATION

A. Coordination: Contractor shall coordinate the Work as stated in the General Conditions of the Contract. Work of the Contract includes coordination of the entire work of the Project, from beginning of construction activity through Project closeout and warranty periods. Contractor shall also coordinate Work under the Contract with work under separate contracts by University. Contractor shall cooperate with University and others as directed by University's Representative in scheduling and sequencing the incorporation into the Work of University Furnished/ Contractor Installed (UFCI) products identified in the Contract Documents.

1. Coordinate completion and cleanup of work of the separate trades, subcontractors, vendors, etc., in preparation for University occupancy

2. After University occupancy, coordinate access to site by various trades, subcontractors, vendors, etc., for correction of defective work and/or work not in accordance with Contract Documents, to minimize University disruption.

3. Assemble and coordinate closeout submittals specified in Section 017700 – CLOSEOUT PROCEDURES.

B. Construction Interfacing and Coordination: Layout, scheduling and sequencing of Work shall be solely Contractor's responsibility. Contractor shall bring together the various parts, components, systems and assemblies as required for the correct interfacing and integration of all elements of Work. Contractor shall coordinate Work to correctly and accurately connect abutting, adjoining, overlapping and related elements, including work under separate contracts by University and utility agencies, if any.

C. Installation of Systems into Project Space: Follow routings shown for pipes, ducts and conduits as closely as practicable, as shown on the Contract Documents with due allowance for available physical space; make runs parallel with line of building. Utilize space efficiently to maximize accessibility for other installations, future maintenance and repairs. In finished areas, except as otherwise shown, conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

D. Utility Work: Work occurring on or in the immediate vicinity of critical utilities must be directly supervised at all times by Contractor's qualified personnel. Requirements stated herein for notification, work plans, dig notification forms and marking locations of existing utilities shall apply. Contractor will be held fully liable for costs and damages due to unplanned interruption of critical utilities, including any personal injury to Hospital patients, visitors, or staff.

1. Provide supervision and coordination necessary to meet requirements of electrical power connection as set forth by the Sacramento Municipal Utility District (SMUD).

2. Provide reasonable and convenient staging and access areas to permit SMUD, its vendors or subcontractors, to install, modify or remove electrical transformers or other components of the electrical power system furnished and installed by SMUD.

1.06 COORDINATION OF SUBCONTRACTORS AND SEPARATE CONTRACTS

A. Conflicts: Conflicts shall be resolved by the Contractor. Contractor bears primary responsibility for conflict resolution regarding the coordination of all building trades, subcontractors and suppliers.

B. Superintendence of Work: Contractor shall appoint a field superintendent who shall direct, supervise, and coordinate all Work in the Contract Documents.

C. Subcontractors, Trades and Materials Suppliers: Contractor shall require all subcontractors, trades, crafts and suppliers to coordinate their portions of Work with the Superintendent to prevent scheduling, sequencing, dimensional and other conflicts and omissions.

D. Coordination with Work Under Separate Contracts: Contractor shall coordinate and schedule Work under Contract with work being performed for Project under separate contracts by University. Contractor shall make direct contacts with parties responsible for work of the Project under separate contracts, in order to provide timely notifications and to facilitate information exchanges.

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

1.07 UNIVERSITY CRITERIA

~~A. During the Base Construction time, Contractor shall allow University [enter specific number of calendar days] to move University equipment and/or provide furnishings in [specify area]. Contractor shall notify University's Representative in writing a minimum of fourteen (14) calendar days prior to completion of area described above.~~

~~1. Contractor shall show this time as a distinct activity on the detailed project schedule.~~

B. Equipment Coordination: Contractor and University supplied equipment will require complete installation data be exchanged directly between Contractor and vendors and subcontractors involved as progress of Project requires. Individual requesting information shall advise when it is required. Incorrect, incomplete, delayed or improperly identified equipment causing delay or error in installation will require entity causing such action to be liable for modifications or replacements necessary to provide correct and proper installation, including relocations.

C. Contractor shall provide large scale casework and equipment drawings for casework and equipment service rough-in locations (dimensioned from building features), service characteristics, and locations of studs or blocking where such locations are critical to mounting or otherwise installing equipment and casework. Furnish sizes and spacing required for mechanical and electrical cutouts, and a complete brochure of fittings, sinks, outlets, or other information to provide a complete assemblage of the items and accessories being furnished.

D. Interruption of Services: Construction Work shall accommodate University's use of surrounding and adjacent premises during the construction period and shall provide continuous public access and use of surrounding and adjacent facilities. Contractor shall not deny access to public use facilities until an alternate means of public use has been provided. An interruption of service is defined as any event which in any way interrupts, disrupts or otherwise discontinues, even momentarily, the services provided by University to its patients and staff. Adequate notice, as described below, shall be given to University when any interruption of services or interference with the use of existing buildings and roads are anticipated. Any interruption of service will be made only by University upon such notice. Interruptions to University services will not be made without prior notification and approval by University. Contractor shall never interrupt any University service without direct University participation.

1. Dig Notification: Contractor shall complete and submit for review to University's Representative, a Dig Notification Form, included at the end of this section, and obtain written authorization from University prior to the commencement of any digging activities. Digging activities include exploratory demolition, soils excavation, concrete core drilling, and saw cutting. Contractor shall include all pertinent information with the Dig Notification Form and submit with detailed work plan fourteen (14) calendar days prior to desired digging activity.

2. The Contractor shall contact USA North 811 prior to starting underground Work to locate existing underground utilities.

3. Contractor shall mark locations of all known utilities on ground of dig area with marker paint.

4. Prior to commencement of digging activities, Contractor shall verify project inspector has inspected the dig site and confirmed the site marking as accurate, complete and in conformance with site utility plans.

5. Contractor shall verify with University's Representative that all interested hospital departments have been notified of intent to begin digging operation.

6. Record documents are required for dig activities. Contractor shall provide As-Built drawings.

E. Shutdown Procedures: Contractor shall complete and submit for review and approval to University a Request for Shutdown form, included at the end of this section. Contractor shall include all pertinent information to assist University in coordination of shutdown activities. The Shutdown Request Form shall be submitted with a detailed work plan addressing the proposed shutdown not less than fourteen (14) calendar days prior to desired shutdown.

F. The University does not normally charge for its shutdown support services. However, if poor planning and/or poor execution of a shutdown by the Contractor causes excessive time and effort for University personnel, the University reserves the right to back charge the Contractor for this effort required to support such shutdown.

1. Contractor shall verify with University's Fire Marshal that all appropriate Interim Life Safety Measures (ILSM) are in place.

2. Contractor shall determine that proper and appropriate coordination and notification has been completed, including written authorization from University's Representative, prior to shut down.

3. Service shutdowns shall require specific work plans to be submitted to and coordinated with University's Representative. Work Plan should reflect various work trades, activities or entities requiring active participation with University teams to coordinating hospital functions with construction activities.

    a. Contractor shall request, schedule, and conduct a General Work Plan Meeting prior to any work activity occurrence. During this meeting Contractor and University shall produce and agree to a list of work activities, which will require digging and/or shutdown coordination and procedures.

b. University's Representative, upon receiving the agreed submission for coordination, shall schedule the actual digging and/or shutdown at the earliest possible date not later than fourteen (14) calendar days from receipt of the submission. Operation of valves, switches, etc. to affect shutdowns shall be operated by University personnel only.

c. A shutdown is defined as any interruption of services provided by University to its patients and staff.

4. Planned service shutdowns shall be accomplished during periods of minimum usage. Contractor shall plan work to restore service in minimum possible time and shall cooperate with the University to reduce number of shutdowns.

a. Notwithstanding the provisions of Article 14.6 of the General Conditions of the Contract, Contractor may be required to perform certain types of work outside normal time periods.

1) Non-normal times shall include, but not be limited to, periods of time before 7:00 a.m. and after 3:00 p.m. in the evening, weekend days, or legal holidays, or such periods of time which constitute split shifts or split working periods.

2) Contractor shall include allocation of the cost of this work as part of the base bid and shall not be entitled to additional compensation as a result of such work during non-normal time periods.

3) Contractor shall include the non-normal periods as distinct activities on the detailed project schedule.

4) Contractor is advised and shall be prepared, at University written request, to perform certain shutdown and asbestos related work during non-normal time periods.

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

H. Detailed Work Plans: Contractor shall develop and submit for review and approval to University's Representative detailed work plans for specific work activities, both inside and outside the work area, associated with impact to, or interruption of services and operation, and dig activities. Work Plans shall be submitted as a PDF electronic file with Table of Contents indexed. Work Plans shall include written description of work activity, detailed schedule with proposed sequence of operation and activity duration, type of equipment to be used, a copy of site plan highlighted to indicate sequencing and location of work and

equipment, completed Request for Shutdown and/or Dig Notification forms as applicable, conformance to ILSM, and control methods for noise, vibration and airborne contaminants.

1. Work Plan submittal will not be accepted unless all required information is provided at time of submittal.

2. Submit Work Plan at least fourteen (14) calendar days prior to the commencement of any associated work activities.

3. Coordination/Engineering Drawings: Contractor shall provide a complete set of Coordination/ Engineering Drawings that indicates the architectural and structural building components; and combines all piping, conduits, fire sprinkler system, equipment, hangers, braces and other building components into one composite drawing for each floor, wing or area of work. Submit the Coordination/ Engineering Drawings as a bookmarked PDF electronic file. These drawings are for the Contractor's and University's use during construction and shall not be construed as replacing any shop drawings, "As-Builts", or record drawings required elsewhere in the Contract Documents. University's review of these drawings is for design intent only and shall not relieve the Contractor of the responsibility for coordination of all work performed per the requirements of the Contract.

    a. Contractor shall prepare and submit complete 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

REQUEST FOR SHUTDOWN (RFS) INFO/IMPACT REPORT

PROJECT NAME: **Central Plant Repair Steam Condensate System Supports**

UNIVERSITY RFS# _____

PROJECT #: 9557960 **HCAI #:** _____ **CONTRACTOR RFS #:** _____

TODAY'S DATE: _____ **SHUTDOWN DATE:** _____ **SUSPEND DATE:** _____

TO: UC DAVIS HEALTH **Facilities Design & Construction** **4800 2nd Avenue, Suite 3010** **Sacramento, CA 95817** **P: 916-734-7024** **mhgomez@ucdavis.edu**	**FROM:**

Request Date: _____ **Shutdown Target Date:** _____

Requested By: _____ **Requestor's Phone #:** _____

Shutdown Work (**Utility Specific**): _____

Scope (**Brief Description of Work**): _____

Impact (**Areas & Users**): _____

Additional Comments: _____

DIG NOTIFICATION FORM

PROJECT #: 9557960 **HCAI#:** _____ **DATE:** _____

TO: UC DAVIS HEALTH **Facilities Design & Construction** **4800 2nd Avenue, Suite 3010** **Sacramento, CA 95817** **P: 916-734-7024** **mhgomez@ucdavis.edu**	**FROM:** _____

1. Has USA been notified? YES___ NO___
   When? _____
2. Are all known utilities marked? YES___ NO___
3. Location of dig shown on attached site plan? YES___ NO___
   Purpose _____
4. **Dates digging will take place** _____
   Place _____

Signed: _____

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: _____ Signed: _____

Comments: (Utilities encountered, disruptions, successes, weather, etc.)

Copies: **University** _____ **Consultants** _____ **File**_____

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SECTION 01 32 20

CONSTRUCTION PROGRESS REPORTING

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements and procedures for documentation of construction progress using still photographs, videos, webcam**.**

2. Requirements and procedures for As-built Documentation

B. Related sections include the following:

1. Division 01, Section “Closeout Procedures” for general closeout procedures.

2. Division 01, Section “Closeout Submittals.”

1.02 PROGRESS PHOTOS/VIDEOS

A. Maintain a 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 **daily**.

3.03 Contractor to review As-Built Conditions with University Representative **Monthly** with Pay App submission.

END OF SECTION 01 32 20

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SECTION 01 33 00

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Administrative requirements for shop drawings, product data and samples submittals

B. University's and University's Consultant's review of submittals

C. Contractor's review of submittals

D. Shop Drawing Submittals

E. Product Data submittals

F. Sample submittals

G. Field Samples and mock-ups

H. Submittal Schedule requirements

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK: Subcontractor and materials suppliers list.

B. Section 013200 – CONTRACT SCHEDULES: Submission and review of schedules and submittals.

C. Section 014500 – QUALITY CONTROL: Test and Inspection Reports.

D. Section 016100 - PRODUCT REQUIREMENTS

E. Section 017700 – CLOSEOUT PROCEDURES: Occupancy/Acceptance /Final Payment Submittals.

F. Section 017800 – CLOSEOUT SUBMITTALS: Preparation of Maintenance and Operating Data.

1.03 ADMINISTRATIVE REQUIREMENTS

A. General Submittals Review: Submittals shall be made in accordance with requirements specified herein and in individual Sections.

1. Submittals shall be a communication aid between Contractor, University’s Representative, and University's Consultant(s) by which interpretation of Contract Documents requirements may be confirmed in advance of construction.

2. Submit on all products to be used on the Project. Make all submittals through the University unless otherwise directed.

a. The University’s Representative shall provide timely review of submittals and re-submittals.

1) University’s Representative shall have twenty-one (21) days from receipt to review all submittals twenty-one (21) days from receipt to review re-submittals.

2) The Fire Marshal shall have twenty-eight (28) days from receipt to review all submittals twenty-eight (28) days from receipt to review re-submittals.

3) University’s Representative will prepare and keep a log of review time of all submittals.

3. Substitutions shall be submitted in accordance with Section 016100 – PRODUCT REQUIREMENTS.

4. Make submittals sufficiently in advance of construction activities to allow shipping, handling and review by the University's Representative and their consultants.

B. University's and University's Consultants Review: University's Consultant's review will be only for general conformance with the design intent of the Contract Documents. Review of submittals is not conducted for purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. Review actions of the University's Consultant or University shall not relieve Contractor from compliance with requirements of the Contract Documents. Changes shall only be authorized by separate written Change Order in accordance with the General Conditions of the Contract.

C. Contractors Review: Contractor shall review, mark-up as appropriate and stamp Shop Drawings, Product Data, and Samples prior to submission. Submittal shall clearly show it has been reviewed by Contractor for conformance with the Contract Documents and for coordination with requirements of the Work. Notify University's Representative in writing, at time of submission, of any changes in the submittals from requirements of Contract Documents.

1.04 SUBMITTAL REQUIREMENTS

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

B. Preparation: Title each submittal with the University’s Project Name and the University’s Project number, submittal date and dates of any previous submissions. Clearly mark each copy to identify product or model.

1. Identify each item on submittal by reference to Drawing sheet number, detail, schedule, room number, assembly or equipment number, Specification number Reference Standard (such as ASTM or Fed Spec Number) and other pertinent information to clearly correlate submittal with Contract Documents.

2. Include the names of the Contractor, Subcontractor, Supplier and Manufacturer.

3. Include field dimensions, clearly identified as such to establish relationship to adjacent or critical features of the Work or materials.

4. Include pertinent information such as performance characteristics and capacities, wiring or piping diagrams and controls, catalog numbers and similar data.

5. Modify manufacturer's standard schematic drawings and diagrams and other diagrams to delete information not applicable to the Work. Supplement standard information to provide information specifically applicable to the Work.

6. Identify changes from requirements of the Contract Documents.

7. Include 8" x 3" blank space on face of submittal for review stamps.

8. Include Contractor's review stamp, initialed or signed, and dated, certifying to the review of the submittal, verification of materials, field measurements, conditions, and compliance of the information within the submittal with the requirements of the Work and of the Contract Documents.

C. Number of submittals required:

1. Product Data Submittals: Submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies.

2. Initial/Re-submitted Shop Drawing Review(s): Submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies.

3. Final Shop Drawing Review and Approval: After obtaining University's Representative approval of initial/re-submitted shop drawing submittals, as described in Section 1.04.C.2 above, Contractor shall submit PDF electronic file with booked marked table of contents and/or sheet index. Submittals for the Fire Department require an electronic file and two (2) hard copies. Contractor is responsible for providing all approved shop drawings for its use and use by subcontractors and/or suppliers.

4. Samples: Submit number specified. Samples shall be of sufficient size and quality to clearly illustrate the functional characteristics of the products, with integrally related parts and attachment devices, including full range of colors, textures and patterns.

D. Identifying Submittals: Identify each submittal by Specification section number followed by a number indicating sequential submittal for that Section. Re-submittals shall use the same number as the original submittal, followed by a letter indicating sequential re-submittal. Examples:

1. 092500 – 1 First submittal for Section 092500 – Gypsum Board

2. 092500 – 2 Second submittal for Section 092500 – Gypsum Board

3. 092500 – 2A Re-submittal of second submittal for Section 092500 – Gypsum Board

4. 092500 – 2B Second re-submittal of second submittal for Section 092500 – Gypsum Board

E. Resubmission Requirements: Revise and resubmit as specified for initial submittal. Identify any Changes other than those requested. Note any departures from Contract Documents or changes in previously reviewed submittals.

F. Grouping of Submittals: Unless otherwise specifically permitted by University's Representative, make all submittals in groups containing all associated items as described in each Specification Section. The University's Representative will reject partial submittals as incomplete.

G. Unsolicited Submittals: Unsolicited submittals will be returned NOT REVIEWED.

1.05 DISTRIBUTION

A. Reproduce and distribute finalized copies of Shop Drawings and Product Data, to the following:

1. Contractor's Project site file.

2. As-built Documents file maintained by Contractor.

3. Pertinent Separate Contractors.

4. Pertinent Subcontractors.

5. Pertinent Supplier or Manufacturer.

1.06 FIELD SAMPLES AND MOCK-UPS - NOT USED)

~~A. Erect at the project site, at a location directed by University's Representative, mock-ups to a size as specified.~~

~~1. The following mock-ups are required for this project:~~

~~2. (**CONSULTANT TO LIST**)~~

~~B. Fabricate each Sample and mock-up to be complete and fully furnished. Unless otherwise agreed, full-size complete samples will be returned and may be incorporated into field mock-ups and Work.~~

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

1.07 SUBMITTAL SCHEDULE

A. Submittals Schedule: refer to Section 013200 – CONTRACT SCHEDULES.

1. The Submittal Schedule is a schedule for submission of Shop Drawings, Product Data and Samples by Contractor, and the processing and return of same by University.

2. Contractor shall prepare the Submittal Schedule as described herein and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted to and accepted by University.

3. Submittal Schedule shall be adjusted to meet needs of construction process and the Contract Schedule. Submit PDF electronic file with booked marked table of contents and/or sheet index of the Submittal Schedule after it is completed and each time it is update by Contractor.

4. Contractor shall NOT begin fabrication or Work which requires submittals until the return of final reviewed and approved submittals have been received by the Contractor.

1.08 ENVIRONMENTAL PRODUCT DECLARATIONS

A. Contractor must comply with Buy Clean California Act requirements per California Public Contract Code, Sections 3500-3505.

B. Contractor shall submit to Project Manager/Construction Manager current facility-specific Environmental Product Declaration for each eligible material proposed to be used on the Project.

C. Environmental Product Declaration (EPD): Type III environmental impact label, as defined by the International Organization for Standardization (ISO) standard 14025, or similarly robust life cycle assessment methods that have uniform standards in data collection consistent with ISO standard 14025, industry acceptance, and integrity.

D. Eligible Materials: Any of the following:

1. Carbon steel rebar.
2. Flat glass.
3. Mineral wool board insulation.
4. Structural steel.

E. Eligible Materials installed on the Project by Contractor must comply with any standards to the extent established in the BCCA or by University, whichever is more stringent. The facility-specific global warming potential for any Eligible Materials must not exceed any existing maximum acceptable global warming potential for that material pursuant to the BCCA or by University, whichever is more stringent (“EM Standards”). The standards are published on the Department of General Services (DGS) website and updated information can be found on this link: https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act

F. Contractor shall not install any eligible materials on the project before submitting a facility-specific Environmental Product Declaration for that material.

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 33 00

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SECTION 01 34 00

CONTRACTOR(S) EMERGENCY PROCEDURES

PART I - GENERAL

1.01 The purpose of this specification is to outline, to the Contractor, the University's policy and procedures for effective project site management of an emergency 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

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SECTION 01 35 00

SPECIAL PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Interim Life Safety Measures (ILSM)

B. Security Procedures

C. Hazardous Materials Procedures

1.02 RELATED SECTIONS

A. General Conditions of the Contract

B. Section 011100 – SUMMARY OF THE WORK

C. Section 013100 – COORDINATION

D. Section 013200 – CONTRACT SCHEDULES

E. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS

F. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

G. Section 017300 – CUTTING AND PATCHING

H. Section 017400 – CLEANING

1.03 INTERIM LIFE SAFETY MEASURES (ILSM)

A. ILSM Definition: Interim Life Safety Measures are those activities that are undertaken during construction, repair, and improvement operations that are established to temporarily compensate for the deficiencies caused in fire safety and protection that may be associated with such projects.

B. Quality Assurance: Interim Life Safety Measures (ILSM) program shall comply with The Joint Commission Standards, Life Safety (LS) Section, LS.01.02.01.

1. **Contractor** shall be responsible for setting up control procedures to adhere to ILSM Criteria Implementation Matrix and/or the ILSM Inclusion Criteria. Contractors shall notify University's Representative of anticipated and actual problems complying with ILSM.

2. **Contractor** shall submit proposed Fire and Life safety impairments (21) calendar days prior to implementation. Submittal of ILSM does not infer or guarantee acceptance by University. All submitted measures shall be reviewed and returned to **Contractor** indicating approval, approval as noted, or rejection, revision, or re-submittal requirement by University in writing no less than fourteen (15) calendar days prior to proposed implementation. If re-submittal is required, twenty-one (21) day review period from date of re-submittal will be required.

C. Project ILSM Procedures: If a life safety code deficiency occurs, or is identified by any source, or the requirements of the current Life Safety Code are not being met, Interim Life Safety Measures must be implemented to the extent necessary to compensate for any deficient element(s) predicated on magnitude, severity, extent and duration before corrective actions are completed.

Any minor life safety code deficiency that could be corrected within 45 calendar days that is confined to a single smoke compartment or fire zone 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.

1.05 HAZARDOUS MATERIALS PROCEDURES

A. Except as otherwise specified, should **Contractor** encounter site materials, reasonably believed to be asbestos, polychlorinated biphenyl (PCB), radioactive material, lead in paint, lead lining in walls or glass windows, lead in ceramic products, mold, water leaks or other hazardous materials or conditions, the **Contractor** shall immediately stop work in the affected area and report the condition to University's Representative in writing. The work in the affected area shall not thereafter be resumed except by written agreement of University and **Contractor** if in fact the material is identified as hazardous and has not been rendered harmless. The work in the affected area shall be resumed in the absence of hazardous materials, or when such materials have been rendered harmless.

B. 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

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

	Yes	No
Project alters or significantly compromises exit access, exiting, or exit discharge building elements? 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

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

Requestor's Signature	Date
UCDH Fire Marshal's Office Representative	Date

Information:

I.L.S.M.

Interim Life Safety Measures Requirement Verification Card

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

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SECTION 01 41 00

REGULATORY REQUIREMENTS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Relationship between Code, Ordinances, Standards and Contract Documents

B. Applicable Codes, Laws and Ordinances

C. Project Inspections

D. California State Fire Marshal Requirements

E. Department of Health Care Access and Information Projects

1.02 RELATED SECTIONS

A. Section 013500 – SPECIAL PROCEDURES

B. Section 014200 – REFERENCES

C. Section 014500 – QUALITY CONTROL

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

A. Authority: All codes, ordinances and standards referenced in Contract Documents shall have full force and effect as though printed in their entirety in the Contract Specifications.

B. Precedence:

1. Where specified requirements differ from requirements of applicable codes, ordinances and standards, the more stringent requirements shall take precedence.

2. Where Contract Drawings or Contract Specifications require or describe products or execution of better quality, higher standard or greater size 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

2) California Building Code, California Code of Regulations – Title 24, Part 2, Volume 1& 2

3) California Electrical Code, California Code of Regulations – Title 24, Part 3

4) California Mechanical Code, California Code of Regulations – Title 24, Part 4

5) California Plumbing Code, California Code of Regulations – Title 24, Part 5

6) California Energy Code, California Code of Regulations – Title 24, Part 6

7) Elevator Safety Construction Code, California Code of Regulations – Title 24, Part 7

8) California Historical Building Code, California Code of Regulations – Title 24, Part 8

9) California Fire Code, California Code of Regulations – Title 24, Part 9

10) California Existing Building Code, California Code of Regulations – Title 24, Part 10

11) California Referenced Standards Code, California Code of Regulations – Title 24, Part 12

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

1) NFPA 13 – Standard for the Installation of Sprinkler Systems.

2) NFPA 14 – Standard for the Installation of Standpipe and Hose System

3) NFPA 72 – National Fire Alarm and Signaling Code

4) NFPA 80 – Standard for Fire Doors and Other Opening Protectives

5) NFPA 99 – Health Care Facilities Code

6) NFPA 101 – Life Safety Code

7) NFPA 252 – Standard Methods of Fire Tests of Door Assemblies

8) NFPA 701 – Standard Methods of Fire Tests of Flame Propagation of Textiles and Films

c. California Code of Regulation Series (embodied in California model codes as noted above)

1) Title 8, Industrial Relations

2) Title 17, Public Health (Chapter 7)

3) Title 19, Public Safety

4) Title 21, Public Works

5) Title 22, Social Security

6) Title 24, Parts 1, 2, 3, 4, 5, 9 and 12

7) Title 25, Energy Insulation Standards

d. Americans with Disabilities Act (ADA) 2010 (Federal Law)

e. Rules and regulations of private and public utilities

f. American National Standards Institute (ANSI)

g. American Society of Testing Materials (ASTM)

h. Federal Specifications (Fed. Spec.)

i. Underwriters Laboratories

j. Traffic controls per California MUTCD requirements

2. All dates to comply with editions adopted and accepted by University and California State Fire Marshal (CSFM).

3. Unless otherwise specified, specific references to codes, regulations, standards, manufacturers' instructions, or requirements of regulatory agencies, when used to specify requirements for materials or design elements, shall mean the latest edition of each in effect at the date of submission of bids, or the date of the Change Order, as applicable.

4. References on Drawings or in Specifications to "code" or "building code' not otherwise identified shall mean the codes specified above, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction having authority over the project.

B. Other Applicable Laws, Ordinances and Regulations:

1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of Federal, State and local governmental agencies and jurisdictions having authority over the Project.

2. Work shall be accomplished in conformance with all regulations of Public Utilities and utility districts.

3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to Contract Time or Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to execution date of the Agreement.

4. General **Contractor** shall not self-perform specialty contracting work defined in sections 7055 – 7059.1 of the California Business and Professions Code unless the General **Contractor** has the specialty **Contractor**'s license appropriate for the work performed. Otherwise, specialty contractors shall be retained by the **Contractor Contractor** to perform specialty work identified in the project scope.

1.05 PROJECT INSPECTIONS

A. Provision of inspectors by University, if any, or by Department of Health Care Access and Information pursuant to this Section and Section 1.04 above shall be subject to the following:

1. **Contractor** shall allow inspectors full access to Project at all times.

2. **Contractor** shall not take any direction, approvals or disapprovals from inspectors.

3. **Contractor** shall not rely on inspectors to ensure Work is completed in accordance with Contract Documents.

4. Acts of omissions of any inspector (including without limitation inspector's failure to observe or report deficiencies in **Contractor**'s Work) shall not relieve **Contractor** for responsibility to complete Work in accordance with Contract Documents.

1.06 DEPARTMENT OF HEALTH CARE ACCESS AND INFORMATION PROJECTS - NOT USED

~~A. Department of Health Care Access and Information (HCAI) is the agency having jurisdiction over all acute care medical project design and construction unless a Memorandum of Understanding (MOU) has been established assigning University staff to perform regulatory duties.~~

~~B. HCAI will approve an inspector for the Project who shall have full access to the Project at all times.~~

~~C. HCAI will require Verified Report forms to be filed per testing, inspection and observation form during construction and a final verified report at completion of the project. Separate verified reports are required from Consultants, Project Inspector, and **Contractor**.~~

~~D. HCAI will require a Building Permit for project submitted by University's Representative. No HCAI Building Permit fees are required to be paid by the **Contractor**.~~

~~E. HCAI will require Change Order Approval submitted by University's Representative.~~

~~F. HCAI will require a Licensed **Contractor**'s Declaration from the **Contractor**.~~

~~G. HCAI projects shall comply with the 2016 California Administration Code.~~

1.07 DEFERRED APPROVAL – NOT USED

~~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

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SECTION 01 42 00

REFERENCES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Definitions and terms used in Contract Documents

B. Reference

C. Standards used in Contract Documents

D. Common abbreviations and acronyms which may be used in Contract Documents

1.02 RELATED SECTIONS

A. Section 014100 – Regulatory Requirements

1.03 DEFINITIONS OF TERMS

A. Basic Contract Definitions: Words and terms governing the Work are defined in the General Conditions of the Contract, provided in the Contract Documents.

B. Additional words and terms are used in the Drawings and Specifications and are defined as follows:

1. Applicable: As appropriate for the particular condition, circumstance or situation.

2. Approve (d): Used in conjunction with action on submittals, applications, and requests, is limited to duties and responsibilities stated in the General Conditions. Approvals shall only be valid if obtained in writing and shall not apply to matters regarding the means, methods, techniques, sequences and procedures of construction. Approval shall not release **Contractor** from responsibility to fulfill Contract requirements.

3. And/or: If used, shall mean that either or both items so joined are required.

4. By others: Work on the project that is outside the scope of Work to be performed under the Contract, but that will be performed by University, separate contractors or other means.

5. **Contractor**-Furnished/University-Installed (CFUI): Items, systems or equipment purchased by the **Contractor** as part of the project and handed over to the University for installation.

6. Construction Site: Same as site.

7. Directed: As instructed by University or University's Representative, in writing, regarding matters other than the means, methods, techniques, sequences and procedures of construction. Terms such as "directed", "requested", "authorized", "selected", approved", "required", and "permitted" mean "directed by University's Representative", requested by University's Consultant" or University's Representative and similar phrases. No implied meaning shall be interpreted to extend the University's Representative responsibility into **Contractor**'s supervision of construction.

8. Equal or Equivalent: As determined by the University's Consultant as being of the same quality, appearance, utility, durability, finish, function, suitability, and performance.

9. Furnish: Means "supply and deliver, ready for unloading, unpacking, assembly, installation, and similar operations".

10. Indicated: Refers to graphic representations, notes or schedules on Drawings, or Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used, it is to help locate the reference.

11. Install: Describes operations at the site including unloading, unpacking, assembly, erection, anchoring, applying, working to dimension, protecting, cleaning, and similar operations.

12. Installer: "Installer" is the **Contractor** or an entity engaged by the **Contractor**, as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

    a. Experienced Installer: The term "experienced", when used with "installer" means having a minimum of five (5) previous Projects similar in size to this Project, and familiar with the precautions required, and with requirements of the authority having jurisdiction.

13. Jobsite: Same as site.

14. Necessary: as determined in the professional judgement of the University Representative through the University's Consultant as being necessary for the Work, in conformance with the requirements of the Contract Documents, and

excluding matters regarding the means, methods, techniques, sequences and procedures of construction.

15. Noted: Same as indicated.

16. Owner-Furnished/ **Contractor**-Installed (UFCI): Item, system or equipment furnished by University at its cost and installed by the **Contractor** as part of the Work.

17. Per: In accordance with or in compliance with.

18. Products: Materials, systems or equipment.

19. Project site: Same as site.

20. Proper: As determined by the University's Representative as being proper for the Work, excluding matters regarding the means, methods, techniques, sequences and procedures of construction, which are solely the **Contractor**'s responsibility to determine.

21. Provide: Means "furnish and install, complete and ready for use".

22. Regulation: Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, and rules, conventions and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

23. Required:

    a. As required by regulatory requirements of governing authorities.

    b. As required by referenced standards.

    c. As required by existing job conditions.

    d. As generally provided by accepted construction practices of the locale.

    e. As indicated on the Drawings and in the Specifications.

    f. As otherwise required by the Contract Documents.

24. Scheduled: Same as indicated.

25. Selected: As selected by University's Representative or University's Consultant from the full national product selection of the manufacturer, unless otherwise specifically limited in the Contract Documents to a particular quality, color, texture or price range.

26. Shown: Same as indicated.

27. Site: Same as Site of the Work or Project Site; the area or areas or spaces occupied by the Project and including adjacent areas and other related areas occupied or used by the **Contractor** for construction activities, either exclusively or with others performing other construction on the Project. The extent of the

Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

28. Testing Laboratories: Same as Testing and Inspection Agency.

29. Testing and Inspection Agency: An independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.

30. University-Furnished/**Contractor**-Installed (UFCI): Same as Owner-Furnished/ **Contractor**-Installed.

1.04 REFERENCE STANDARDS

A. References: The Drawings and Specifications contain references to various standards, standard specifications, codes, practices and requirements for products, execution, tests, and inspections. These reference standards are published and issued by the agencies, associations, organizations and societies listed in this Section or identified in individual Sections of the Specifications.

B. Relationship to Drawings and Specifications: Such references are incorporated into and made a part of the Drawings and Specifications to the extent applicable.

C. Referenced grades, Classes and Types: Where an alternative or optional grade, class or type of product or execution is included in a reference but is not identified in the Drawings or Specifications, provide the highest, best and greatest of the alternatives or options for the intended use and prevailing conditions.

D. Copies of Reference Standards:

1. Reference standards are not furnished with the Drawings and Specifications. It is the responsibility of the **Contractor**, subcontractors, manufacturers, suppliers, trades and crafts to be familiar with these generally recognized standards of the construction industry.

E. Jobsite Copies:

1. **Contractor** shall obtain and maintain at the Project site copies of reference standards identified on the Drawings and in the Specifications in order to properly execute the Work.

F. Edition Date of References:

1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition or latest revision published as of the date of the Contract.

2. All amendments, changes, errata, and supplements as of the effective date shall be included.

G. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision or amendment. It is the responsibility of the

Contractor to be familiar with and have access to these nationally, and industry recognized specifications and standards.

1.05 ABBREVIATIONS & ACRONYMS

A. Abbreviations and Names: Where acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction or other entity applicable.

B. Refer also to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

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

AA	Aluminum Association
AAA	American Arbitration Association
AAC	Architectural Anodizers Council
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ACPA	American Concrete Pumping Association
ADA	Americans with Disabilities Act
ADC	Air Diffusion Council
AFSA	American Fire Sprinkler Association
AGA	American Galvanizers Association (formerly AHDGA)
AGA	American Gas Association
AGC	Associated General Contractors of American
AI	Asphalt Institute
AIA	American Institute of Architects
AIMA	Acoustical and Insulation Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association International
ANSI	American National Standards Institute
APA	Engineered Wood Association (formerly American Plywood Association)
APWA	American Public Works Association
ARMA	Asphalt Roofing Manufacturers Association
ASAC	American Subcontractors Association of America
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BOC	Board of Corrections
CABO	Council of American Building Officials
CAC	California Administrative Code (see California Code of Regulations (CCR)
CAL/OSHA	State of California Construction Safety Orders
CBC	California Building Code
CCR	California Code of Regulations
CEC	California Electrical Code
CFC	California Fire Code
CFR	Code of Federal Regulations
CIMA	Construction Industry Manufacturers Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers' Institute
CMC	California Mechanical Code

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

D. Words and terms not otherwise specifically defined in this Section or in the Contract Documents, shall be as customarily defined by trade or industry practice, by reference

standard and by specialty dictionaries such as Dictionary of Architecture and Construction (Cyril M. Harris, McGraw-Hill Educational; 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

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SECTION 01 45 00

QUALITY CONTROL

PART I - GENERAL

1.01 SECTION INCLUDES

A. **Contractor**'s Quality Control

B. Quality of the Work

C. Inspections and tests by governing authorities

D. Inspections and tests by serving utilities

E. Inspections and tests by manufacturer's representatives

F. Inspections and Independent testing and Inspection Laboratories/Agencies

G. **Contractor**’s responsibilities in inspections and tests

H. **Contractor**’s responsibilities regarding the University’s testing laboratory

I. Test reports

J. Geotechnical engineer

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

B. Section 014100 – REGULATORY REQUIREMENTS: Compliance with applicable codes, ordinances and standards.

C. Section 014550 – INSPECTION and TESTING of WORK

D. Section 016100 – PRODUCT REQUIREMENTS: Product Options, substitutions, transportation and handling requirements, storage and protection requirements, and system completeness requirements.

1.03 **CONTRACTOR**'S QUALITY CONTROL

A. **Contractor** 's Quality Control: **Contractor** shall ensure that products, services, workmanship and site conditions comply with requirements of the Contract Documents by coordinating, supervising, testing and inspecting the Work and by utilizing only suitably qualified personnel.

B. Quality Requirements: Work shall be accomplished in accordance with quality requirements of the Contract Documents, including, by reference, all Codes, laws, regulations and standards. When no quality basis is prescribed, the quality shall be in accordance with the best-accepted practices of the construction industry for the locale of the Project, for projects of this type.

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

1.04 QUALITY OF THE WORK

A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects and fit for the intended use.

B. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements and adjacent construction.

C. Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling and staining, until Acceptance by University.

D. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report (ICC) requirements in preparing, fabricating, erecting, installing, applying, connecting and finishing Work.

E. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviation is acceptable and appropriate for the Project.

F. Verification of Quality: Work shall be subject to verification of quality by University's Representative and University's Consultant in accordance with provisions of the General Conditions of the Contract.

1. **Contractor** shall cooperate by making Work available for inspection by University's Representative, University's Consultant or their designated representatives.

2. Such verification may include mill, plant, shop, or field inspection as required.

3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured, fabricated or stored.

4. Provide all information and assistance as required, including that by and from sub**Contractor**s, 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.

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

List the applicable services required, for example:

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

E. 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 (If applicable or NOT USED)

A. University will retain and pay the expense of a Geotechnical Engineer to perform inspection, testing and observation functions specified by university. Geotechnical Engineer will communicate only with University. University's Representative shall then give notice to **Contractor**, of any action required of **Contractor**.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

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SECTION 01 45 10

SEISMIC CONTROL – HCAI

PART I - GENERAL

1.01 DESCRIPTION

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

1.02 QUALITY ASSURANCE

A. ASTM standards

B. 2019 California Building Code, Title 24 (CBC)

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this Section including shop drawing and other documentation to comply to the requirement of this Section.

B. Submit special seismic certification (OSP) for mechanical and electrical equipment/components as noted on CBC 1705A.13.3.1. Contractor shall bear all costs associated with all tests, engineering calculations and documentation required to obtain Department of Health Care Access and Information (HCAI) approval in accordance with this section in a timely manner if the Contractor chooses to select equipment that does not already have special seismic certification as noted on the design documents.

C. Submit HCAI Pre-approved Manufacturer’s Certification (OPM) as noted on the design drawings with only one applicable OPM per application.

PART II - PRODUCTS

2.01 SEISMIC RESTRAINT REQUIREMENTS

A. SUMMARY

1. This section covers the seismic restraint requirements for suspended distribution systems, vibration and non-vibration isolated items, systems and/or related suspended equipment.

2. The designers of record (DOR) as referenced in this specification shall be the project architect, structural engineer, and the appropriate system engineer (e.g., electrical, etc.).

3. An HCAI OPM determined by the DOR shall be considered as the specified seismic design for this project. Other non-OPM designs may be submitted as an alternate if they meet or exceed all the requirements contained within these specifications, HCAI pre-approved service loads, installation applications, and engineering services.

4. Channel framing materials, fittings and related accessories shall be as indicated on the OPM and on the drawings. All channel members (trapezes and braces) shall be solid strut. Field drill bolt holes at 1/16" larger than bolt size as required for connections. Back-to-back struts shall be stitch groove welded or button welded.

5. To facilitate plan review and construction, all construction documents should include an equipment schedule identifying all applicable equipment, its classification (fixed, movable, mobile, other, countertop, interim or temporary) and reference to support and attachment per Pin 68-Table 1.

B. SEISMIC RESTRAINT DESIGN

1. The attachment supports and seismic restraints of suspended non-structural components and distribution systems listed below shall be designed to resist the total design seismic forces prescribed in the CBC.

   a. All equipment/components including but not limited to: electrical, mechanical, plumbing, fire sprinkler and architectural.

   b. Without referencing OPM or HCAI pre-approved seismic attachment and supports shown on the design document, seismic support and attachment shall be engineered and built by the applicable system contractor. Engineering shall be performed (signed & sealed) by a licensed California Structural Engineer and submitted to the DOR and HCAI for acceptance prior to installation. Cost to be borne by the contractor.

   c. Design and installation shall consider seismic relative displacement in accordance with ASCE 7-16-13.3.2.

   d. Pipes with hazardous contents including but not limited to medical gas, fuel oil, natural gas piping, etc., regardless of size and weight shall be seismically braced per the OPM or HCAI pre-approved design.

   e. Support and attachment requirements for fixed, interim, mobile, movable, other, and temporary equipment shall be in accordance with HCAI PIN 68.

2. Seismic restraint transverse and/or longitudinal spacing shall be in accordance with CBC and OPM and limited to the following:

   a. Seismic design forces equal to or less than the capacity of the building structure.

   b. 40' feet transversely and/or 80' feet longitudinally where pipes, conduits, and their connections are constructed of ductile materials (copper, ductile iron, steel, or aluminum and brazed, welded, or screwed connections).

   c. 20' feet transversely and/or 40' feet longitudinally where pipes, conduits, and their connections are constructed of nonductile materials (e.g., cast

iron, no-hub pipe, and plastic).

d. 20’ feet transversely and/or 40’ feet longitudinally for bus ducts and cable trays, baskets, channels.

3. Contractor shall not adopt, use, or otherwise implement the omission of any seismic restraints without prior review and acceptance by the designers of record. All submittals for omission of seismic restraints must include the following and must be performed (signed & sealed) by a licensed California Structural Engineer and approved by HCAI.

   a. Project specific cover letter clearly indicating that said engineer has completely reviewed the project documents, and that the items/systems were designed individually and in coordination with all other trades and references the code section(s) where the omission of seismic restraints is allowed.

   b. Lateral motion of the supported items/systems shall not directly or indirectly impact adjacent life safety, emergency services and/or hazardous items/systems or their supports.

4. Seismic hardware brackets shall provide a (Captive) 360-degree connection that completely encloses or encircles the rod, anchor, bolt, fastener, etc. Open hook and/or open slot seismic hardware brackets shall not be allowed.

5. Seismic restraint assembly connections shall not incorporate the use of break-off bolts or nuts and pneumatic fasteners unless referenced in the OPM document.

6. Ceiling system shall not be used as a seismic restraint, sway brace and/or safety restraint material.

7. Non-seismic and/or safety restraints sway bracing shall meet or exceed that required for the attachment of seismic restraints to the building structure.

8. Seismic restraints shall be installed to provide a minimum of (2) two transverse and (1) one set of (2) two longitudinal braces per run and per the OPM document.

9. The accumulated load of multiple items at any given support (with or without seismic restraints) shall not overload the building structure and the support assembly.

10. Pipes, conduits, and other items attached to trapeze hangers shall be located uniformly along each individual trapeze hanger so that the accumulated load is evenly distributed.

11. Trapeze systems installed in a multi-layer configuration shall have seismic restraints designed and installed for each individual trapeze layer.

12. Design of supports, seismic restraints and anchorage to the structure shall consider all conditions that involve thermal, structural separation, relative displacement, building expansion and contraction.

13. SMACNA details shall not be used without prior approval by Structural Engineer of Record (SEOR).

C. ACCEPTABLE MANUFACTURERS

1. HCAI Pre-approved Certified Manufacturer (OPM)

D. ANCHORS, INSERTS AND FASTENERS

1. All anchors, inserts, fasteners, or connections to the structure shall be submitted to the structural engineer of record for review and acceptance prior to installation.

2. Do not use any anchor or insert in concrete or metal decking with concrete fill, which does not have one of the following:

a. ICC evaluation report

b. HCAI pre-approval

3. Cast-in-place inserts that contain internal threads shall include the installation of a jam or lock nut to secure the connection of the vertical support rod to the cast-in-place insert.

4. Cast-in-place inserts that allow for horizontal adjustment shall not be allowed unless an engineered solution is provided to assure positive captured positioning and secured attachment.

5. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or internally threaded anchors in concrete or metal decking with concrete fill without prior scanning of the slab and wall for clearances, and to prevent damages to embedded electrical conduits and/or mechanical piping and reinforcing steel.

6. All beam clamps shall be constructed of malleable iron or steel. All single flange mounted beam clamps shall include a retaining strap or J-hook and must be submitted to the project structural engineer of record 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 Authority Having Jurisdiction (AHJ).

2. Special inspection for special seismic certification per CBC 1705A.12.4.

PART III - EXECUTION

3.01 SEISMIC ANCHORING AND RESTRAINTS

A. Equipment anchors:

1. All equipment shall be anchored. Anchor equipment per details shown on the drawings where provided.

2. Anchor installation shall be in accordance with the current ICC report.

3. Anchor details provided are based on specific equipment information. Submit design for approval for anchoring of equipment which varies from design.

B. Conduit supports:

1. Conduits shall be supported and braced per CBC.

C. Lighting fixture supports:

1. Provide independent seismic support system per CBC.

D. Minimum clearance:

1. Diagonal braces and hanger supports shall maintain 6 inches minimum clearance from unbraced ducts and conduits, and 1-inch minimum clearance from braced ducts and conduits.

2. Except for sprinklers installed using flexible sprinkler hose, installed clearance shall be 3 inches between any sprinkler drop or sprig and permanently attached equipment and other distribution systems, including their structural supports and bracing.

3.02 INSTALLATION AND TESTING OF MECHANICAL ANCHORS:

A. Where permitted in other Sections of this specification, drilled-in expansion-type anchors or other post-installed concrete anchors may be used in hardened concrete.

B. All post-installed concrete anchors shall be tested. Testing shall be performed in the presence of the Inspector of Record. Number of anchors to be tested shall be as shown on the drawings with a minimum of 50% of anchors installed and at each support. Testing shall be performed by torque or pull test, and to the values noted on the drawings. Test loads, frequency, and acceptance criteria of post-installed anchors in concrete shall be in accordance with CBC 1910A.5.

C. Internally threated shell-type anchors and displacement-controlled anchors (e.g., drop-in anchors, screw anchors, adhesive anchors, etc.) shall not be tested using a torque wrench.

D. Screw anchors shall be installed with a calibrated torque wrench and may be loosened a maximum of one full turn to facilitate the positioning of a tension test collar. Following the tension test, the anchor shall be re-torqued in accordance with the manufacturer’s installation instructions.

E. Tension test of chemical/adhesive anchors and power actuated fasteners shall be in accordance with CBC and as noted on the drawings.

F. All testing procedures shall be in accordance with CBC 1910A.5, and as noted on the drawings.

G. Locate existing reinforcing steel and conduits in slabs and walls prior to drilling holes for the mechanical anchors.

END OF SECTION 01 45 10

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SECTION 01 45 50

INSPECTION AND TESTING OF WORK

PART I - GENERAL

1.01 SECTION INCLUDES

A. Project Inspections and Procedures

B. Scheduling Inspectors – Notification requirements

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

B. Section 013200 – CONTRACT SCHEDULES

C. Section 013500 – SPECIAL PROCEDURES

D. Section 014100 – REGULATORY REQUIREMENTS

E. Section 014500 – QUALITY CONTROL

1.03 DEFINITIONS

A. IOR: Inspector-of-Record

B. ACO: Area Compliance Officer for HCAI

C. DSE: District Structural Engineer for HCAI

D. FM: Fire Marshal (may include both HCAI FM and State FM)

E. TL: Testing Laboratory

1.04 PROJECT INSPECTIONS AND TESTING PROCEDURES

A. Inspections: This Project (is) (is not) under the jurisdiction of the Department of Health Care Access and Information. The following inspections will be requested on this project, as appropriate. Also see Part 3 for non-HCAI inspection items or Part 3, Item 3.11 for HCAI requirements.

1. Inspections required by the California Building Code

2. Inspections listed on the Testing, Inspection and Observation (TIO) form

3. Final inspections

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.

1. IOR Inspection Request Notification: Twenty-four (24) hours. Note: Inspection requests received by 2:00 PM will be scheduled for next day inspection. Inspection requests received after 2:00 PM will be scheduled for the following day; (example: Inspection request received at 2:01 PM on a Monday would be scheduled for inspection on Wednesday). Weekend and off-hours inspection requests will be scheduled on a case-by-case basis with a minimum of seventy-two (72) hour inspection request notification.

2. HCAI Field Compliance Inspectors: Fourteen (14) calendar days.

3. Testing Laboratory Inspections: Forty-eight (48) hours.

   a. All testing laboratory and testing procedures must be scheduled by University's Representative. Inspections and/or testing directly scheduled by **Contractor** will not be accepted.

   b. **Contractor** will bear all costs associated with unauthorized inspections and testing.

4. State Fire Marshal Inspection Request Notification: Seventy-two (72) hours.

B. Methods of Inspection Notification:

1. All inspection notifications shall be in writing using inspection forms located at back of this Section. Incomplete forms will be returned as non-compliant, and no inspection will be scheduled until all required inspection information is provided.

2. Emailed inspection requests will be accepted. University's Representative email address is lfuka@ucdavis.edu Notification time begins from the date and stamp of the email, provided it is sent during normal business hours. Emailed inspection requests sent after normal business hours and/or received on non-normal workdays, as defined in Specification Section 013100 – COORDINATION, paragraph 1.07.F.4.A will begin notification time starting at 7:00 AM the following normal business day.

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

D. Re-inspections:

1. More than two (2) re-inspections: The cost of re-inspections of the same work, more than twice, shall be deducted from Contract Sum. University will provide itemized invoice for **Contractor**'s records.

2. Work unprepared for inspection: Re-inspections of the same work scheduled by **Contractor**, but not ready for inspection will be identified as a re-inspection.

PART II - PRODUCTS – Not Applicable to this Section.

PART III - EXECUTION

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

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

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

A. 1 Hour: IOR test 100%. State Fire Marshal tests 100% or as needed.

B. 2 Hour: IOR tests 100%. State Fire Marshal tests 100%.

C. Smoke: IOR tests 100%. State Fire Marshal tests 100%.

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

A. Approved drawings shall be on jobsite from start to completion of project.

B. Underground pressure test @ 200 psi.

C. State Fire Marshal to witness installation of underground lines.

D. State Fire Marshal to witness underground flush prior to connection.

E. Hydro-test above ground piping @ 200 psi for two (2) hours.

F. Inspection of hangers, bracing, and seismic joint crossing(s).

G. Flow alarm test, tamper switch test.

H. Fire pump test.

I. Certification by installer (Title 24, Part 9, Article 1006.3.4.2).

J. Final inspection: signs in place, labeling, fire extinguishing system flow alarm test.

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

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

A. Approved drawings shall be on jobsite from start to completion of project.

B. Verify Emergency Power source.

C. Activate all initiating devices.

D. Certification by installer (Title 24, Part 9, Article 1006.3.4.2).

E. Complete test of system per Title 24, Part 9, CFC, Article 1003.3.4.1).

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

A. Exit sign/light locations and connected to two (2) sources of power.

B. Normal Power.

C. Emergency Electrical System, Life Safety Branch.

D. Construction - floors, walls, ceilings, penetrations per listings.

E. Electrical boxes - no back to back, 24 inches horizontal separation (Section 709).

F. Electrical boxes - 100+ square inches to be wrapped/protected.

G. Flame Spread, Fuel Contribution and Smoke Density for finishes (Chapter 8).

3.05 EMERGENCY LIGHTING

A. Generator Test (Title 24, Part 3, Section 700-4; Section 701-5).

B. Emergency lights - locations (Title 24, Part 2, Volume 1, Chapter 10, Section 1003.2.8.5).

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

A. Approved drawings shall be on jobsite from start to completion of project.

B. State Fire Marshal to witness system test.

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

A. Mechanical Equipment Requirements

1. Access to Equipment (Section 305, 405, 606.5, 815, 2.2.8, 903, 910.8, 1106.3).

2. Labeling of Equipment (Section 307).

3. Identification of Equipment - Area or Space Served (Section 304.5).

B. Mechanical Testing

1. Air balance completed and reviewed by Mechanical Engineer-of-Record.

2. Hospitals (Chapter 3, Section 314.1, Table 2110-A).

3. Skilled Nursing (Chapter 3, Section 314.2) [test to include humidity controls in required areas - Section 2102(a)].

4. Hydronic balance completed and reviewed by Mechanical Engineer-of-Record.

5. Air and Hydronic reports forwarded to Mechanical Engineer of Record.

6. Fuel Gas line inspection (Part 4, Section 1406 and Appendix B, Chapter 16).

7. Atrium and/or Building Smoke Evacuation System (State Fire Marshal to witness).

C. Boilers

1. Boiler – Operating Adjustments and Instructions (Section 1022).

2. Boiler – Inspections and Tests (Section 1023).

3. Boiler – Clearances/Permits (Section 1005.0).

D. Ducts

1. Installation - Bracing (Part 4, Section 604.1.4)

2. Fire Damper test log from IOR (Part 4, Section 606.2).

3. Fire Damper test by State Fire Marshal (Part 4, Chapter 6, Section 606.2).

4. Smoke Damper and Detector test log from IOR (Including Duct Detector tests).

5. Smoke Damper and Detector by State Fire Marshal.

E. HVAC Unit Testing

1. Verify correct filter types and efficiencies.

2. Motor Rotation.

3. Condensate drain tests (Section 310).

4. Equipment shut down by smoke detectors (duct or space).

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

A. Piping Systems (Title 24, Part 5)

1. Domestic Water Line Sterilization Test (Title 24, Part 2, Section 609.9; Title 22, Division 4, Chapter 16, Article 5).

2. Domestic Water System (hot, cold) Pressure test (Title 24, Part 5, 609.4).

3. Natural Gas Pressure Test (Title 24, part 5, Chapter 12, Section 1204).

4. Vent & Waste System Pressure test (Title 24, Part 5, 712.0).

5. Hydronic Water Pressure test (Title 24, Part 4 1201.2.8).

B. Water Heater Testing

1. Water Heater Temperature Test (Domestic/Patient) (105-120°F).

2. Water Heater Temperature Test (Kitchen) (180°F).

3. Water Heater Temperature Test (Laundry) (169°F).

4. Water Heater Temperature Alarm Test (Patient) (125°F).

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

1. Pressure test - 150 psig - Oxygen, Medical Air & Nitrous Oxide (4-3.4.1.2).

2. Pressure test - 200 psig - Nitrogen (4-5.1.3.4).

3. 24-hour pressure test - 60 psig - Vacuum system (4-10).

4. 24-hour pressure test - 20% over operating pressure [A-4.3.4.1.2 (b)(e)].

5. Alarm test for system [4-3.4.1.3 (d)].

6. Area Valves, location, labeled, alarms tested (4-4.1 & 4-5.1.4).

7. Laboratory testing affidavits - welding/brazing (4-6.2.3.3).

8. Verified Medical Air Quality - Installation and 24 hour later.

9. Certification of system (Purity, Cross Connection, Alarms, Etc.) [4.5].

10. Certification of Bulk System [NFPA 50 (Oxygen) & CGA G-8.1 (Nitrous Oxide)].

11. Approved drawings and documents for submittal to University's Representative for permanent records).

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

A. Main Panel/Service

1. Identification and Labeling of Equipment (110-21, 110-22, 230-70).

2. Grounding test and Certification (250, 250-56).

3. Ground fault interrupt test adjustment and certification [230-95(c); 517-17(c)].

4. Emergency power transfer switch test (700-4).

5. Panel load balance.

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

1. Emergency Generator testing and certification (701-5).

2. Identification and Labeling of equipment (110-21, 110-22, 517-22).

3. Lighting and Lighting Levels (517-22).

4. Receptacles (410L, 517-13, 517-18, 517-19).

5. Exiting signs and lights [517-32(b), 517-42(b)].

6. Nurse and Staff Call [517-33(a)].

7. Fire Alarm (760).

C. General Electrical Requirements

1. Working space/Headroom [Table 110-26(a); 110-33; 110-34].

2. Circuits and lights tested (410-45).

3. Receptacle polarity and grounding [200-10(b)].

4. Isolated ground monitor test [517-160(b)].

5. Motor load current adjustment.

6. Identification and Labeling of equipment (110-21; 110-22).

7. Identify circuits (Critical Care Areas) (517-19).

D. Miscellaneous Electrical Requirements

1. Test logs from **Contractor** and Inspector-of- Record.

2. Electrical Engineer-of-Record acceptance of system.

3. Owner In-Service training on Equipment.

4. Equipment Manuals and Instruction to Owner.

5. Warrantees and Equipment Certification.

6. As-Built documents to Owner.

3.10 FIRE MARSHAL INSPECTION REQUIREMENTS

A. Framing Inspections

1. Structural members in fire-resistive construction.

2. Check fireproofing per approved design tested assembly description.

B. Fire-Rated Partition Locations

1. Check for stud and nailing/screwing spacing per approved design tested assembly description.

2. Check for fire blocking in combustible construction.

3. Check for rated door/window frame installation (manufacturer's installation instructions shall be available for review).

4. Check for electrical installation, for example, number and size of electrical boxes, panels, cabinets, etc.

5. Check hangers, seismic bracing for sprinkler piping installation, if applicable (this would be checked during overload pressure test inspection phase of sprinkler system).

C. Close-In Inspections

1. Check fire-blocking and draft stops in combustible construction.

2. Check gypsum board installation in accordance with approved design assembly description for rated assembly.

3. Check integrity of firewall construction where recessed cabinets, panels, excessive electrical/plumbing are installed.

4. Check fire damper installation (manufacturer's installation instructions shall be available for review). Fire Marshal will witness actuation of minimum 10% fire dampers installed and 100% in 2 hour or greater fire rated wall assemblies.

5. Check for through-penetrations and fire-stop systems in all walls or floor/ceiling assemblies.

    a. Check top of wall to structure fire stopping.

6. Check above ceiling areas and construction prior to installation of ceilings.

    b. Check access and serviceability for above ceiling to included but not limited to valves, mechanical equipment, electrical equipment and other components that require adjustment, access or service.

    c. **Contractor** shall move any items including but not limited to conduit, piping, braces and other obstructions that block access to equipment and components needing adjustment, access or service.

    d. Check bracing, anchorage, fasteners and installation.

D. Final Construction Inspections

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

3.11 HCAI – Testing, Inspection and Observation (TIO)

Note: This item describes the required code related inspection items for HCAI projects. It will be completed by design professional prior to construction. This checklist is not intended to be all-inclusive, and Contractor should verify actual inspection requirements. (Attach completed and approved HCAI TIO form signed by Architect/Engineer of Record for required testing.) Refer to attached TIOCBSC-2022-HCAI_OSHPD1.

3.12 Refer to the following attachment.

A. Inspection Request

B. Non-conforming Work Notice

END OF SECTION 01 45 50

INSPECTION REQUEST

Project #: _____ **HCAI #:** _____ **UCDH IR #:** _____ **Contractor IR #:** _____ **Date:** _____

Project **Spec Section**

Name: _____ **(s):** _____

To: UC Davis Health	**From:**
Facilities Design & Construction – Inspection Group	
4800 2nd Avenue, 2nd Floor	
Sacramento, CA 95817	
Email: lfuka@ucdavis.edu & Project IOR	**P:**
	E-mail:

Drawing Ref.: _____ **Detail:** _____ **Shop Drawing:** _____

Project Schedule Activity ID No.: _____ **Date of Inspection:** _____ **Time Requested:** _____

Type of Inspection: _____

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

***Re-inspection Requested for Previous UCDH IR #:** _____

All work Requested for Inspection has been reviewed for compliance with the contract documents by Contractor's Superintendent prior to notification of Inspection Request.

Signed: _____ **Date:** _____

UNIVERSITY USE ONLY

Date Received: _____ **Time of Inspection:** _____

Date of Inspection: _____ **Inspector:** _____ ☐ **Inspection Report Attached**

Inspector Arrival Time: _____ **Inspector Departure Time:** _____

Comments: _____

☐**Approved** ☐**Approved as Noted** ☐**Not Approved** ☐ **Cancelled**

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

Project Field Record of Construction Progress Summary of Work in Progress (Part 1, Chapter 7, Section 7-145, item 6)
Project Phase (Building Foundation, Structural, Wall Framing, Electrical Rough-In, Sprinkler Rough-In, etc.)
Project Phase Percentage Complete (% of the phase completed): **Overall Project Percentage Complete:**

NON-CONFORMING WORK NOTICE

PROJECT #: _____ **HCAI #:** _____ **Notice #:** _____ **Date:** _____

To: UCDH PM, Michael Gomez
Weston & Associates, Adam Davis
Area Compliance Officer, HCAI, Masoud Abolhassani

From: UC Davis Health IOR
Facilities Design & Construction – Inspection Group
4800 2nd Avenue, 2nd Floor
Sacramento, CA 95817
P: 916-734-5060

Spec Section Ref.: _____ **Paragraph:** _____ **Drawing Ref.:** _____

Detail: _____

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

Reported by: _____

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

Description of corrective action taken: _____

Accepted by: _____ **Date:** _____

CC:

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SECTION 01 51 00

TEMPORARY UTILITIES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Temporary Power and Lighting.

B. Temporary Heating, Cooling & Ventilation.

C. Temporary Water.

D. Temporary Fire Protection.

E. Temporary Telephone, Data, and WIFI.

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

B. Section 013500 – SPECIAL PROCEDURES: General requirements for temporary facilities and controls, to accommodate the University's occupancy and use of the areas and spaces adjacent to construction.

C. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

D. Section 017400 – CLEANING

E. Section 017700 – CLOSEOUT PROCEDURES

1.03 TEMPORARY UTILITIES

A. Temporary Connections: Temporary power, water, sewer, gas and other utility services necessary for the Work may be made to existing building systems. Connections shall be subject to University's review and written approval. Coordinate with utility companies and University's Plant Operations & Maintenance Department for locations and methods of connections.

B. **Contractor** shall provide and pay for installation, operation, maintenance, and removal of all utilities. The services will be provided at the current rates for each utility.

1.04 TEMPORARY POWER AND LIGHTING

A. Service Requirements:

1. Temporary Electrical Service: **Contractor** shall provide and pay for installation, operation, maintenance, and removal of temporary electrical service, lighting devices and restoration of existing and permanent equipment in accordance with applicable provisions of the Electrical Safety Orders of the State of California. Use of University's electrical power and lighting system is prohibited without

University's written approval and will be considered only when an alternate electrical power source is unavailable.

a. Install initial services at time of site mobilization.

b. Modify and extend systems as Work requires.

c. Maintain electrical system to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.

d. Restore existing and permanent lighting used during construction to original condition. Replace defective fixtures, bulbs, and other component parts.

e. Clean existing and permanent lighting fixtures used during construction per Section 017400 – CLEANING.

2. Distribution: **Contractor** shall provide distribution network for temporary electrical power.

3. Power Source: Arrange for service with University's Plant Operations and Maintenance Department, or local utility company.

4. Conformance: All temporary wiring and electrical facilities shall be in accordance with applicable provisions of Electrical Safety Orders of the State of California.

5. Temporary Lighting: Construction lighting shall be supplied and maintained by **Contractor** at 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:

~~1. Weatherproof distribution boxes with one (1) - 240-volt, three (3) phase power outlet and four (4) – 120-volt outlets consisting of 100 amperes fused switches with equipment ground, spaced so a 100-foot extension cord will reach all areas of building.~~

2. Wiring, connections, and protection for temporary lighting.

3. Wiring connections and protection for temporary and permanent equipment, for environmental control, for temporary use of electricity operated equipment, and for testing.

C. Use of University System: If alternate electrical power and lighting sources are unavailable, University may permit **Contractor** to use existing, in-place electrical system. University does not guarantee availability of electrical power or adequate lighting levels through use of existing system. If power and lighting is insufficient or not available **Contractor** shall provide secondary source (i.e., generator) as approved by university.

1. It is expressly understood and agreed by **Contractor** that University existing power and lighting system's primary obligation is servicing patient care. The University system is not designed for purposes of construction activities.

2. **Contractor** should expect power and lighting interruptions during course of Work. **Contractor** will be required to cease use of university electrical-power and lighting systems, as required by the needs of university.

3. When use of university electrical system is approved in writing, **Contractor** is required to adhere to University's electrical lockout procedures. See Division 26– Electrical or Campus Design Guidelines.

a. Provide and maintain warning labels on energized equipment.

b. Replace plates, electrical devices or similar existing items or components damaged as a result of temporary usage.

1.05 TEMPORARY HEATING, COOLING AND VENTILATING

A. Service Requirements:

1. **Contractor** shall provide temporary heat as necessary for proper installation of all work and to protect all work and materials against injury from dampness and cold and to dry out building. Fuel, equipment and method shall be approved in writing by University’s Representative.

2. Install initial services at time of site mobilization. Modify and extend systems as Work requires.

3. Maintain systems to provide continuous service, including prompt restoration of interruptions to University systems when temporary service is connected.

4. Use of permanent heating system is preferred to any other system for maintaining temperature of building during installation of finish materials, but such use will not be permitted before clean-up after plastering and/or drywall work has been completed. **Contractor** shall make every effort to complete permanent heating

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

a. Vent portable units to building exterior, complete with automatic controls. Direct-fired units are not allowed. Locate units and outlets to provide uniform distribution of heating, cooling and ventilating.

b. Operate and maintain existing equipment being used; clean or replace filters and install filters in duct extensions as necessary to maintain occupied areas, work areas and finished areas, in specified condition.

c. Prior to operation of permanent equipment, verify controls and safety devices are complete, equipment has been tested, and inspection made and approved for operation.

d. Remove temporary materials and equipment when permanent system is operational. Restore existing and permanent systems used for temporary purposes to original condition.

e. Install temporary filters in air handling units and ducts, replace as necessary to prevent dust in equipment and ducts, to avoid contaminants in Work or finished areas. After completion, replace temporary filters with new, clean, reusable filters.

5. Maintain temperature, humidity, and ventilation in enclosed areas to provide ambient conditions for storage, preparation and Work; to cure installed materials, to prevent condensation, to dry floor surfaces and to prevent accumulations of dust, fumes and gases.

6. During non-working hours maintain temperature in enclosed areas occupied solely by **Contractor** at a minimum of 50ºF., or higher as specified in individual Sections and by individual product suppliers and manufacturers. Areas occupied in whole or in part by University are to be maintained at normal temperatures.

7. Provide high efficiency particulate air (HEPA) filters as specified in SECTION 015610 – AIRBORNE CONTAMINANTS CONTROL, negative pressure ventilation, or special control of existing system as determined by University's Representative.

B. Utility Sources:

1. Electrical: As specified above in Item 1.04.

2. Existing mechanical systems may be used for temporary purposes. Coordinate use with University for conditions to be maintained in adjacent University occupied areas.

3. **Contractor** shall provide and pay for all installation, operation, maintenance, and removal of equipment in accordance with applicable provisions of the Electrical Safety Orders of the State of California.

1.06 TEMPORARY WATER

A. Service Requirements:

1. Maintain systems to provide continuous service, including prompt restoration of interruptions to University's systems when temporary service is connected.

2. Water service, if necessary for construction, can be made available at no expense to the **Contractor** provided the water is not wasted. **Contractor** shall be responsible for distribution of water to points of use.

3. Certified reduced pressure type back-flow prevention device as submitted to and approved by University shall be installed before water is obtained from a University campus fire hydrant or interior building connection.

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

1. Size piping to supply construction needs, temporary fire protection, and for University's needs when existing service is connected.

2. Disinfect piping used for drinking water. See Division 33 and 22 for requirements or Campus Design Guidelines

3. Source: University existing service, connect at locations as directed by University.

4. Provide valved outlets to control water pressure adequately for hoses.

5. Fire hydrants used for water supply for construction – **Contractor** must use only ⅞" 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 using 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 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.

E. Temporary Internet Service: Provide a high-speed internet connection (Min. 20 Mbps download, 10 Mbps upload) to **Contractor**'s field offices. The **Contractor**'s and University's field offices shall be capable of sending and receiving e-mail and be able access the Internet.

1. ~~**[WIFI coverage at the above internet speeds will be provided throughout the jobsite]**~~

PART II - PRODUCTS

2.01 MATERIALS

A. May be new or used, adequate to the purpose.

B. Devices and Equipment: Standard devices, meeting UL requirements.

C. Telephones: may be product of local service company or specialty devices compatible with service company requirements.

D. Modems compatible with internet service.

PART III - EXECUTION

3.01 INTERRUPTION OF EXISTING SERVICES

A. No existing utility services shall be interrupted at any time without prior written approval from the University. Required shutdowns shall be scheduled a minimum of fourteen calendar days prior to actual shutdown. The operation of valves, switches, etc. will be performed and paid for by University.

1. Prior to the outage, all possible Work shall have been completed which will minimize the length of the required outage. During the outage, the Work will be prosecuted with diligence by an adequate number of skilled personnel.

2. Provide and pay for all personnel required by the University to maintain safe conditions during the outage including but not limited to fire watch, safety monitors and/or traffic control. Coordinate Work with University's Representative.

3.02 REMOVAL OF TEMPORARY CONSTRUCTION

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

END OF SECTION 01 51 00

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SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART I - GENERAL

1.01 SECTION INCLUDES

A. Construction Parking and Access Roads

B. Traffic Regulation

C. Project Informational Signs

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

C. Section 013500 – SPECIAL PROCEDURES: General requirements for temporary facilities and temporary controls to accommodate University's continued occupancy and use of the areas and spaces adjacent to construction.

D. Section 017400 – CLEANING

E. Section 017700 – CLOSEOUT PROCEDURES: Project Closeout.

1.03 PARKING AREAS AND ACCESS ROADS

A. Access Roads: Existing roads shall be used for construction access within limits defined herein. Temporary construction access roads shall not be permitted.

B. Parking: Parking is controlled and limited by University.

1. Parking of personal vehicles belonging to **Contractor** employees may be arranged with University's Parking Services, at 916-734-2687. Parking will be allowed in employee permit areas, at the current permit rates depending on space availability.

2. Delivery of materials may be made to the job-site as required. **Contractor** shall coordinate with University's Representative.

3. Dumpsters shall be located in approved location as arranged by University's Representative.

4. Parking of company vehicles up to 6 can be parked inside the Central Plant up to 2 months. **Contractor** to coordinate with University 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

~~A. Project Identification Sign: **Contractor** shall provide one (1) project sign. Sign will consist of one (1) 8' x 4'x ¾" exterior grade plywood with medium or high-density phenolic sheet overlay, painted plywood sign on fence area at construction field office or yard.~~

~~1. Information on sign shall include PROJECT NAME, University of California, Davis Health, University's consultants, etc. Copy will be provided by the University.~~

~~B. Painted Informational Signs: Provide at each field office, storage shed and yard, directional signs to direct traffic into and within site. Relocate as Work progress requires.~~

~~C. Maintain signs and supports: Clean, repair deterioration and damages.~~

~~D. Remove signs, framing, supports and foundations at completion of Project and restore the area.~~

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 55 00

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SECTION 01 56 00

TEMPORARY BARRIERS, ENCLOSURES and CONTROLS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Barriers and Enclosures

B. Protected Walkways and Weather Closures

C. Tree and Plant Protection

D. Temporary Controls

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

B. Section 013500 – SPECIAL PROCEDURES

C. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION

D. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

E. Section 017400 – CLEANING

1.03 BARRIERS AND ENCLOSURES

A. Barricades: Provide to prevent public entry, to protect existing trees and plants, and to protect existing facilities and adjacent properties from damage during construction period. Relocate and extend as construction progress requires per California MUTCD requirements.

B. Partitions and Ceiling Enclosures:

1. Fire Enclosures-Rated-Corridors and Rated Assemblies: Provide non-combustible dust-proof barrier framed with 20-gauge metal studs spaced 24" o/c maximum and covered on both sides with ⅝" 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.~~

~~1) Mini containments (pop-up cubes) which are designed to have at most 1-2 people may be used in lieu of custom-built Class II Containments.~~

~~2. The outside of the work containment shall have present: ICRA Permit, Interim Life Safety Measure (ILSM) Permit, Daily ICRA Inspection Forms, entry warning sign, Containment Entry Log (provided by the **Contractor**) that lists all persons who enter the containment regardless of affiliation, including all University employees, and an emergency telephone number of persons to call 24 hours.~~

~~3. Before any demolition or construction begins, all Protection Areas (infection control areas), control measures put in place and work plan by the **Contractor** will be~~

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

3.02 Refer to the following Attachments:

A. Appendix A - Construction Dust & Hazardous Materials Inspection Worksheet

B. Appendix B - Initial Information and Benchmark Containment Inspections

C. Appendix C - Entry Warning Sign with Project Manager Contact Information

END OF SECTION 01 56 00

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

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

ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS

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

CONTAINMENT STRATEGIES

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

PART I - GENERAL

1.01 SUMMARY

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

1.02 POLICY

A. Airborne contaminants control is critical in all hospital areas, as well as non-hospital areas. **Contractor** shall limit dissemination of airborne contaminants produced by construction-related activities, including dust, chalk, powders, aerosols, fumes, fibers and other similar materials, in order to provide protection of immuno-compromised and other patients, staff, diagnostic operations, or sensitive procedures or equipment, from possible undesirable effects of exposure to such contaminants.

1. Construction activities causing disturbance of existing dust, or creating new dust, or other airborne contaminants, must be conducted in tight enclosures cutting off any flow of particles into patient areas.

2. Ceilings, walls in Protection Areas and other areas in patient care areas as indicated on drawings must be secure at all times.

B. An Infection Control Risk Assessment (ICRA) and plan to mitigate dust or other airborne contaminants is required for each project. The risk assessment identifies patient groups at risk for infection due to construction dust. The dust mitigation plan is designed to contain dust within the construction zone.

C. All work at hospital facilities shall follow the recommended UC Davis Medical Center Construction Dust Infection Prevention Best Practices Standard, Version 4.0 – December 2022 or the most recent version.

D. Should the scope of work change or the discovery of additional toxic materials such as asbestos, lead and radioactive materials or biological substances such as visible mold growth, STOP WORK and seek additional approval and guidance before proceeding. If the above potential materials newly discovered during construction, renovation, or repairs, any ICRA in-hand is invalid and risk assessment shall be performed to reevaluate ICRA levels and the work plan prior to restart of the work. Upon discovering, seal any openings, stop work and notify the University's Representative immediately. This includes projects that are already considered and operating under a Class IV.

E. Related Sections:

1. Section 017300 – CUTTING AND PATCHING: Removal of debris may be outside of normal work hours and shall be in tightly covered containers.

2. Section 013500 – SPECIAL PROCEDURES: Perform work in accordance with requirements of this section.

~~3. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION~~

4. Section 015100 – TEMPORARY UTILITIES: Provide high efficiency particulate air (HEPA) filters as specified in Section 015610, negative pressure ventilation, or special control of existing system as determined by University's Representative.

5. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS: Extend barriers above ceilings as required to seal off and contain airborne contaminants.

6. Section 015600 – TEMPORARY CONTROLS: Contain waste materials during removal; bagging, wrapping, and transporting.

7. Section 017400 – CLEANING: Use wet cleaning methods and HEPA filtered vacuum cleaners as required to minimize release of airborne contaminants. Contain waste materials, debris and rubbish as noted above and clean work area daily. Excess construction debris shall be cleaned daily by the end of each work shift. Disinfect Containment and Protection Areas as directed by University's Representative

F. Dust Mitigation Requirements

1. An ICRA Daily Inspection Log 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 immuno-compromised 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 sub**Contractor**'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. **Contractor**s 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 **Contractor**s. The Health System requires that HEPA systems be tested to the ANSI / ASTM standard as delivered prior to their use onsite as further described in this Standard.

D. ICRA (ICRA) Infection Control Risk Assessment - An evaluation of patient risk based on a matrix of the patient population health in the work area and the invasiveness of the project. This assessment ultimately generates a permit (ICRA permit) issued by Infection Prevention requiring compliance with one of five precaution levels. The ICRA program is documented in Hospital P&P 2120. 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 ~~THE BELOW LISTED CRITERIA ARE POSSIBLE STRATEGIES FOR CLASS 3 AND 4 CONTAINMENTS. NOT ALL OF THE STRAGEGIES WILL BE ALLOWED OR REQUIRED. THE ICRA PERMIT AND EH&S WORKSHEET DEFINE WHAT IS ALLOWABLE. THINK OF THE ICRA PERMIT AND EH&S WORKSHEET AS A MENU. THE BELOW IS A DETAILED DESCRIPTION OF EACH ITEM -~~ NOT USED

3.03 CONTAINMENT CRITERIA -~~-~~ NOT USED

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.~~

~~The interior of the containment area shall be.~~

B. ~~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.

3.04 NEGATIVE AIR CRITERIA --NOT USED

A. ~~HEPA filtered air shall not be discharged into existing HVAC supply ducts, return ducts, exhaust ducts or building plenum spaces unless there is a dedicated exhaust duct available in the construction project area and is approved for use by the University Plant Operations & Maintenance.~~

B. ~~The University's Representative shall determine if there is available a dedicated exhaust duct within the project area that is not connected to other exhaust ducts for exhaust out the building. This option can be considered if there are no other ducts attached to the exhaust duct, since other systems attached to the main exhaust duct might be pressurized, changing designed exhaust volumes, or creating back flushing of air in other connected ducts. Use of this option shall be reviewed and approved by University Plant Operations & Maintenance.~~

C. ~~When the air from the HEPA filtered negative air unit exhaust cannot be directed outside of the building due to no windows in the vicinity of the work or if impractical, all HEPA filtered negative air units shall be exhausted to a location agreeable to the PM. Each HEPA unit shall be plugged into a separate electrical circuit to provide temporary redundancy should one unit fail or due loss of electrical power. The PO&M Electrical shop shall inspect and test each circuit connected to the HEPA negative air unit prior to use.~~

D. ~~If negative air exhaust is required to be exhausted through a fire-rated assembly, the air shall be directed through approved fire-rated temporary containment systems that meet ASTM E84, Class A requirements for smoke and fire.~~

E. ~~When the air from the negative air units is exhausted inside of the building, the exhaust air from negative air unit shall be directed into a "diffusion cube" constructed of pleated filters to disperse the air in a manner that does not raise dust or blow air directly onto patients, staff or visitors. The **Contractor** shall consider and install charcoal filters in the negative air units to control smells/odors associated with the construction.~~

F. ~~Negative air units shall be positioned as far from the entry ante room containment as possible for distribution of air flow throughout the project area. The number of negative air units shall be to provide sufficient negative pressure and for a minimum of at least four (4) air changes per hour of the volume of the entire work containment.~~

G. ~~Dual HEPA Units operating in parallel may be required for redundancy in high-risk areas.~~

H. ~~DOP testing of HEPA equipment~~

1. ~~Negative air units and HEPA filtered vacuums are to be challenge tested onsite by the DOP test method by a third party prior to being placed in service, after a HEPA filter change, when dropped or damaged or moved from the project site. Only HEPA systems that pass the challenge DOP testing can be used on the project. All HEPA equipment shall be tested per ANSI/ASME N510 Section 10 to ensure 99.97% efficiency at 0.3 micrometer mean aerodynamic diameter.~~

2. ~~The entire piece of HEPA equipment shall be challenge tested, not just the filter media. The University's Consultant or EH&S shall witness the HEPA challenge testing procedure in entirety. Once the HEPA system passes the challenge testing and passes, the HEPA equipment may be used at the location tested for a period not to exceed one year. The testing label shall remain on the HEPA equipment and remain legible. Re-testing of the HEPA equipment is required annually, if the piece of equipment is transported out of the building to another building location~~

on the campus, if dropped, or otherwise subjected to forces that might unseat the HEPA filter, damaged by water or laceration of the filter or if HEPA filter maintenance or adjustments are performed.

3. When utilizing HEPA Filtered Vacuums for glove boxes or shrouded tools these HEPA Vacuums must be DOP tested.

3.05 NEGATIVE AIR MONITORING CRITERIA --NOT USED

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.

3.06 ADDITIONAL CONTAINMENT CRITERIA - NOT USED

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 sub **Contractor** 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.

3.07 CONTAINMENT SET UP --NOT USED

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.~~

3.08 REMOVAL OF CONTAINMENT --NOT USED

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.

3.09 ENTRY/EGRESS --NOT USED

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

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.

3.10 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.

3.11 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

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UCDAVIS 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 and Name:	Floor:	Suite/Room:
Estimated Construction Start Date:	Estimated Completion Date:		
UCDH Project Manager:	UCDH PM Mobile Phone #:	UCDH PM Email:	
Construction Manager:	CM Mobile Phone:	CM Mobile Email:	

GENERAL PROJECT SCOPE

ATTACH DESCRIPTIVE PROJECT SCHEMATIC OR IMAGE TO PACKET

MULTIDISCIPLINARY TEAM		
Identify the multidisciplinary team included in this review and agree with the requirements identified within the package.		
Department	Name	Email
UCDH Project Manager		
Fire Marshal's Office		
Infection Prevention		
Environmental Health & Safety		
Contractor Representative		
Other Multidisciplinary Team Members		

INFECTION CONTROL RISK ASSESSMENT

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

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
Explain the reasoning for this assessment:	

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

Surrounding Area Assessment

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

Unit Location:	Below	Above	Lateral	Behind	Front
Unit Name:					
Risk Group:					
Unit Contact:					
Phone:					
Email:					
Additional Controls:	☐ Noise ☐ Vibration ☐ Dust control ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust control ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust control ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust control ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust control ☐ Ventilation ☐ Pressurization
Impact on other systems, such as:	☐ Data ☐ Mechanical ☐ Med Gases ☐ Water Systems	☐ Data ☐ Mechanical ☐ Med Gases ☐ Water Systems	☐ Data ☐ Mechanical ☐ Med Gases ☐ Water Systems	☐ Data ☐ Mechanical ☐ Med Gases ☐ Water Systems	☐ Data ☐ Mechanical ☐ Med Gases ☐ Water Systems
Notes:					

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

NOISE AND VIBRATION ASSESSMENT

Type	Suggested Control Measures
☐ Drilling ☐ Heavy Equipment ☐ Motors ☐ Pounding ☐ Grinding ☐ Other:	☐ **Required for high-impact activities** – Notify PO&M, Building Coordinator and EH&S ☐ Always consider using Engineering solutions before using Personal Protective Equipment. ☐ Coordinate disruption plan with PO&M and other stakeholders as necessary ☐ Deploy noise dampening blankets or other similar equipment ☐ Use tools or alternative methods designed to minimize noise and vibrations ☐ Use diamond drills instead of powder-actuated fasteners ☐ Use beam clamps instead of shot ☐ Prefab where possible ☐ Use tin snips to cut metal studs instead of using a chop saw ☐ 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 ☐ Use mechanical joining system sprinkler fittings instead of threaded ☐ 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

Type	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 MATERIALS		
Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)?	☐ Yes	☐ No
How was this verified?	☐ Hazmat Survey	☐ Personal Knowledge
	☐ Other:	
Who verified this information?	☐ Company:	
	☐ Person and Department:	
	☐ Other:	

Hazardous Materials Present in Project Work Area	Required Control Measures
☐ Asbestos ☐ Lead ☐ PCBs ☐ Universal Waste ☐ Other:	Follow work practices outlined in the General Requirements Division 1 Document.

CONTAINMENT REQUIREMENTS WORKSHEET

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

Adjacent High/Highest Risk Areas	Air Balance 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 Contractor Mobile Email:	
Containment will be set up and maintained by:	Third-Party Containment Consultant:		

ICRA Class: Choose an Item		**Project Start Date**	**Completion Date**
Additional Requirements			
Signatures	Project Manager	General Contractor	Infection Control and Prevention
Downgrade Request – ICRA Class Choose an item		**Project Start Date**	**Completion Date**
Additional Requirements			
Signatures	Project Manager	General Contractor	Infection Control and Prevention
Extension Request – 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 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: o Carefully remove screws and painter tape. o If dust will be generated during screw removal, use hand-held HEPA vacuum. o Drywall cutting is prohibited during removal process. o Clean all stud tracks with HEPA vacuum before removing outer hard barrier. o 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

Prior to and During Construction:

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

Upon Completion of Work:

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

Prior to and During Construction:

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

Upon Completion of Work:

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 – 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. o If required, install charcoal filters on air intake to building. o Maintain equipment exhaust scrubbers if working near sensitive areas or near air-intake o Minimize equipment idling • Validate barriers restricting access and signage into construction work areas are maintained.
Upon Completion of Work:	• Ensure all control measures are removed at completion of project.
	Additional Infection Prevention Requirements:

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UC DAVIS 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 in-house 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 (+0.001 and greater)	Active contaminant ejection	This is an emergency. Call Project Manager ASAP!
No pressure (0.000)	Possible contaminant migration	Close zipper doors, Check and repair breaches, Ensure correct operation of negative air machines, and Call Project Manager.
Too Negative (-0. 060 and less)	Could collapse containment	Lift the zipper on the containment and anteroom door

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.

EXAMPLES OF MOBILE CONTAINMENTS OR "CUBES"

"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 OF GLOVE BAGS OR BOXES

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
- ☐ 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

REFERENCES

The following sources were used to gather information for this policy.

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Facilities Guideline Institute (2014). Guidelines for design and construction of hospitals and outpatient facilities. American Hospital Association.

Grota, P, et. al. (Eds.) (2014) APIC Text of Infection Control and Epidemiology. (4th Ed.) Association for Professionals in Infection Control and Epidemiology.

Kanamori H, Rutala WA, Sickbert-Bennett EE, Weber DJ. Review of fungal

outbreaks and infection prevention in healthcare settings during construction and renovation. Clin Infect Dis. 2015 Aug 1;61(3):433-44.

Kidd F, Buttner C, Kressel AB. Construction: a model program for infection control compliance. Am J Infect Control. 2007 Jun;35(5):347-50.

Public Health Agency of Canada. (2001) Construction-related nosocomial infections in patients in healthcare facilities: Decreasing the risk of aspergillus, legionella, and other infections. Ottawa, Ontario: Health Canada.

Rask D, Dziekan B, Swiencicki W, Heinsohn P, Walmsley D. (1998) Air quality control during renovation in health care facilities. In: Healthy buildings: solutions to global and regional concerns. Atlanta, GA: ASHRAE Inc Press; 1998.

Sehulster L, Chinn RY. (2003) Guidelines for environmental infection control in healthcare facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Morbidity and Mortality Weekly Report – Recommendations and Reports, 2003, 52(RR-10):1-42.

Sendelbach S, Funk M. Alarm fatigue: a patient safety concern. AACN Adv Crit Care. 2013 Oct-Dec;24(4):378-86.

Vogel R, et. al. (2015). Infection prevention manual for construction and renovation. Association for Professionals in Infection Control and Epidemiology.

Permit Number:	UCDH Project Manager:	UCDH Project Manager Phone Number:
Project Number:	Project Name:	Alternate Contact:

CONTAIMENT INSPECTION LOG

Type of Inspection Pre Start, Post Demo, Downgrade, Final or Work Day	Date & Time	Performed by (Name & Company)	Pressure Reading (+/-)	Acceptable Negative Pressure? (Yes/No)	ILSM conditions still met? (Yes/No or N/A)	Tack Mat useable? (Yes/No)	Interior free of dust and debris? (Yes/No)	Containment Integrity Intact? (Yes/No)	All ICRA permit conditions met? (Yes/No)	Other Issues? (Explain)	Corrective Actions
Example Work Day	01/13/23 0800	B. Clean ACME Construction	-0.025	Yes	N/A	Yes	Yes	No	Yes	No	Containment Breach; Patched

Caution

Construction Dust Precautions In Use
Do Not Enter

For More Information Contact the UCDH Project Manager

_____

(Name)

_____

Phone Number

This sign must be posted in color

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SECTION 01 61 00

PRODUCT REQUIREMENTS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Product Options

B. Product Substitutions

C. Product Transportation and Handling Requirements

D. Product Storage and Protection

E. Product System Completeness

1.02 RELATED SECTIONS

A. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

~~B. Section 013900 - GREEN BUILDING POLICY IMPLEMENTATION~~

C. Section 014100 – REGULATORY REQUIREMENTS

D. Section 014500 – QUALITY CONTROL

1.03 PRODUCTS

A. Product Selection: Provide products that comply with Contract Documents, are undamaged and unused at installation.

B. Product Completeness: Provide products complete with all accessories, trim, finish, safety guards and other devices needed for complete installation and for intended use and effect.

C. Products: Items purchased for incorporation in Work, whether purchased for project or taken from previously purchased stock; this includes materials, equipment, assemblies, fabrications and systems.

1. Named Products: Items identified by manufacturer's product name, including make or model designation indicated in the manufacturer's published product data.

2. Materials: Products that are shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed or installed to form part of the Work.

3. Equipment: A product with operating parts, whether motorized or manually operated, requiring connections such as wiring or piping.

D. Specific Product requirements: Refer to requirements of Section 014500 – QUALITY CONTROL and other Sections in Division 2 through 49 for specific requirements for products.

E. Code Compliance: All products, other than commodity products prescribed by Code, shall have current listing service report or research report. Minimum Requirements: Specified requirements are minimum requirements.

F. Interchangeability: To fullest extent possible, provide products of the same kind from single source. Products supplied in quantity shall be same product and interchangeable throughout the Work. When options are specified for selection of any of two (2) or more products, product selected shall be compatible with products previously selected.

G. Nameplates: Except for required labels and operating data, do not attach manufacturer's name plates or trademarks on surfaces exposed to view in occupied spaces or on the exterior of building.

H. Equipment Nameplates: Provide permanent nameplate on each item or service-connected or power-operated equipment. Locate on inconspicuous accessible surface. Nameplate shall contain the following information and essential operating data:

1. Name of product and manufacturer

2. Model and serial number

3. Capacity and Speed

4. Ratings and other pertinent information

I. Listing Service: Products, for which listing service standards have been established and for which their service label is available, shall bear the appropriate listing service label.

1.04 PRODUCT OPTIONS

A. Products Specified Only by Description: Where the Contract Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the appropriate characteristics and otherwise complies with the requirements.

B. Performance Specification: Where Contract Specifications require compliance with performance requirements, provide products that comply and are recommended for application. Manufacturer's recommendations may be contained in Product literature, or by certification of performance.

C. Compliance with Standards: Where Contract Specifications require compliance with a standard, select a product that complies with the standard specified.

1. Wherever catalog numbers and specific brands or trade names followed by the designation "to match existing” are used in conjunction with product(s) required by the Contract Specification, no substitution will be considered.

D. Products Specified by Naming One (1) or More Manufacturers:

1. Specified manufacturer(s): Provide specified product(s) of the specified manufacturer. Wherever more than one (1) manufacturer's product is specified, the first-named product is the basis for the design used in the Work and the use of alternative-named products or substitutes may require modifications in that design. If such alternatives are proposed by **Contractor** and are approved by University, **Contractor** shall assume all costs required to make necessary revisions and modifications to the design, including additional costs to university for evaluation of revisions and modifications of the design resulting from the substitutions submitted by **Contractor.**

   a. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or equal" supporting data for second manufacturer's product, if proposed by **Contractor**, shall be submitted in accordance with the requirements for substitution.

2. Quality Standard: Products(s) of the specified manufacturer shall serve as standard by which the product(s) of other named manufacturers are evaluated.

E. "Or Equal" Provision: Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by Contract Specification to establish standard of quality, utility, and appearance required.

1. "Or Equal" Products: Equivalent products of manufacturers other than the specified manufacturer may be provided if determined by University's Representative to be acceptable in accordance with substitution provisions following:

   a. **Contractor** shall submit to University's Representative, within thirty-five (35) calendar days after the date of commencement of the Work specified in the Notice to Proceed, a list in excel format containing Specification Section number with extension i.e. 088000 2.B.1.a. with descriptions of each product proposed for substitution.

   b. **Contractor** shall provide supporting data as required herein.

   c. University will evaluate **Contractor** 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.

a. Product Availability Waiver: Substitutions will be considered after the sixty (60) calendar day period only when a product becomes unavailable due to no fault of the **Contractor**.

F. Visual Matching: Where Contract Specifications require matching a sample, University's decision on proposed product match is final. If no product matches and complies with other requirements, comply with provisions for "substitutions" for selection of a matching product in another category.

G. Visual Selection: Where requirements include the phrase "….as selected from manufacturer's standard colors, patterns, textures…" or a similar phrase, select a product that complies with other requirements. University's Representative will select color, pattern and texture from the product line selected.

1.05 SUBSTITUTIONS

A. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the **Contractor** after award of the Contract shall be considered "substitutions". The following are not considered substitutions:

1. Revisions to Contract Documents requested by University's Representative or University's Consultant.

2. Specified options of products and construction methods included in Contract Documents.

3. Compliance with governing regulations and orders issued by governing authorities.

B. Substitution Provisions: Requests for Substitutions will only be considered if **Contractor** submits the following data:

1. Furnish complete technical data including drawings, performance specifications, samples, test reports and any additional information required by University's Representative, for each product proposed for substitution.

    a. Submit ONE (1) PDF file with bookmarks.

    b. In reviewing supporting data for substitution, University will use, for purpose of comparison, all characteristics of Basis of 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 well-drained area on solid surfaces. Prevent mixing with foreign matter.

3. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and maintained under required conditions, free from damage and deterioration.

E. Protection After Installation: Provide barriers, substantial coverings, notices and other materials or methods as necessary to protect installed work from traffic, subsequent construction operations and weather.

1. Maintain temperature and humidity conditions in interior spaces for Work in accordance with manufacturers' instructions for materials and equipment being protected.

2. Remove protective measures when no longer required and prior to Acceptance of the Work.

1.08 SYSTEM COMPLETENESS

A. The Contract Drawings and Contract Specification are not intended to be comprehensive directions on how to produce the Work. Rather, the Drawings and Specifications are instruments of service prepared to describe the design intent for the completed Work.

B. It is intended that equipment, systems and assemblies be complete and fully functional even though not fully described. Provide all products and operations necessary to achieve the design intent described in the Contract Documents.

C. **Contractor** is urged to report to University's Representative immediately when elements essential to proper execution of the Work are discovered to be missing or misdescribed in the Contract Documents or if the design intent is unclear.

D. Should an essential element be discovered as missing or misdescribed prior to receipt of bids or establishing a negotiated Contract Sum, an Addendum or Clarification will be issued so that all cost may be accounted in the Contract Sum.

E. Should an obvious omission or misdescription of a necessary element be discovered and reported after execution of the Agreement, **Contractor** shall provide the element as though fully and correctly described.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products.

B. Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect to ensure freedom from damage and deterioration at time of Substantial Completion.

3.02 Refer to the following Attachment:

A. Request for Substitution Form.

END OF SECTION 01 61 00

REQUEST FOR SUBSTITUTION

Substitution #: _____ **Submittal #:** _____ **Date:** _____

Project#: 9557960 **HCAI#:** _____

PROJECT NAME: Central Plant Repair Steam Condensate System Supports

TO: UC DAVIS HEALTH **Facilities Design & Construction** **4800 2ND Avenue, Suite 3010** **Sacramento, CA95817** **P: 916-734-7024** **Attn.: mhgomez@ucdavis.edu**	**FROM:** _____

Name of Party Submitting Request for Substitution: _____

Reason for Submitting Request for Submission: _____

Specification Section and Paragraph #: _____

Substitution Manufacturer name and address: _____

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

Fabricators and Suppliers (as appropriate): _____

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:

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SECTION 01 73 00

CUTTING AND PATCHING

PART I - GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching Work.

B. Hazardous Conditions Permit requirements for brazing, welding and other hot work.

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

B. Section 013100 – COORDINATION

C. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

D. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

E. Section 016100 – PRODUCT REQUIREMENTS

F. Individual Specifications Sections.

1. Cutting and patching incidental to Work specified in this Section.

2. Coordination with work in other Sections for openings required to accommodate Work specified in those other Sections.

1.03 SUBMITTALS

A. **Contractor** shall complete and submit for review to University's Representative, a Coring/Sawcutting Form, included at the end of this Section, and obtain written authorization for university prior to the commencement of any dig activities. **Contractor**

shall include all pertinent information with the Coring/Sawcutting Form and submit with detailed work plan fourteen (14) calendar days prior to desired coring/cutting activity.

1. Structural integrity of any element of Project.

2. Integrity of weather-exposed or moisture-resistant element.

3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight-exposed elements.

5. Work of University.

6. Utility supply, drains, fire alarm, communication.

B. Include in request:

1. Identification of Project, including University's Project Name and Project Number.

2. Location and description of affected Work.

3. Necessity for cutting and patching.

4. Description of proposed work, and products to be used.

5. Alternatives to cutting and patching.

6. Effect on work of University.

7. Written permission of University.

8. Date and time work will be executed.

1.04 NOTIFICATIONS

A. Before starting welding or cutting work involving the use of gas or electric welding equipment, or any brazing work involving gas or electric brazing equipment **Contractor** shall complete the online Hazardous Conditions Permit form at https://health.ucdavis.edu/fire/. **Contractor** shall allow seventy-two (72) Hours for Fire Marshal's approval and issuance of Hazardous Conditions Permit. This permit will be issued without cost to **Contractor** and may be applicable to more than one (1) building. **Contractor** shall be responsible for reporting to Fire Department either by telephone or in person at beginning and end of each day's work. Provide minimum written notice of fourteen (14) calendar days prior to such activities.

1. Welding and brazing personnel must be certified by a University or HCAI approved laboratory and must maintain this certification during the work of this Contract.

2. **Contractor** is responsible for notifying University of all apparent locations where suspect asbestos containing materials may be present or discovered during the course of the project such as cement pipes or other insulated material, which may be a result of newly excavated materials below grade or after building systems are opened such as within wall, ceiling or subfloor spaces. When any such location is

discovered by **Contractor**, information relating thereto shall be immediately communicated to University's Representative.

3. Where welding and cutting activity is required and suspect painted surfaces are present that will be impacted by the welding or cutting activity, the **Contractor** shall request from the University's Representative information regarding laboratory analysis for lead or other hazardous metals in the painted metal components before any cutting or welding is performed. The **Contractor** shall refer to Section 013500 Special Procedures, 1.05 Hazardous Materials Procedures regarding materials impacted by welding and cutting activity.

4. **Contractor** shall then follow any and all instructions as indicated by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

A. Product substitution: For any proposed change in materials, submit request for substitution under provision of SECTION 016100 – PRODUCT REQUIREMENTS. Use only materials for cutting, fitting, and patching which comply with the applicable

Specification Sections, and which match adjacent materials. Use materials whose installed performance will equal or surpass that of existing materials.

PART III - EXECUTION

3.01 EXAMINATION

A. General: Execute cutting, fitting and patching including excavation and fill, to complete Work and:

1. Fit the several parts together, to integrate with other work.

2. Uncover work to install ill-timed work.

3. Remove and replace defective and non-conforming work.

4. Remove samples of installed work for testing.

5. Provide openings in elements of Work for penetrations of mechanical and electrical work.

B. Examination, General: Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

1. After uncovering existing Work, inspect conditions affecting proper accomplishment of Work.

2. Beginning of cutting or patching shall be interpreted to mean that existing conditions were found acceptable by **Contractor**.

C. Ground Penetrating Radar: Determine by Ground Penetrating Radar all existing reinforcing, conduit and piping located in concrete walls and slabs prior to demolition. Clearly mark all locations and review with University Representative prior to demolition.

3.02 PREPARATION

A. Temporary Supports: Provide supports to assure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Weather Protection: Provide protection from elements in all areas that may be exposed by uncovering work. Maintain excavations free of water.

C. Protection. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas. Do not block required exit ways or stairs.

E. Protect rated floor, wall and ceiling assemblies. Prior to cutting opening in a rated assemblies review with University’s Representative and get written approval 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

LOCATION: _____ PROJECT#: _____
TITLE: _____

TRACKING NUMBER:
(Provided by PO&M) _____

HCAI #: _____ DATE: _____

TO: **Facilities Design & Construction**
UC Davis Health
4800 2nd Avenue, Suite 3010
Sacramento, CA 95817
P: 916-734-7024
mhgomez@ucdavis.edu

FROM:

SCOPE:

HAS USA BEEN NOTIFIED? ☐ *YES* ☐ *NO* *When?* _____

ARE ALL KNOWN UTILITIES MARKED? ☐ *YES* ☐ *NO* *By Whom?* _____

LOCATION OF WORK SHOWN ON ATTACHED SITE PLANS? ☐ *YES* ☐ *NO* *Purpose:* _____

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

UC DAVIS HEALTH USE ONLY

DATE RECEIVED:

WHO FROM UNIVERSITY WILL AUTHORIZE, SUPERVISE AND VERIFY?
PHONE:

Utilities Verified by IOR? ☐ *YES* ☐ *NO*

Activities coordinated with: ☐ PO&M ☐ Fire ☐ Telecom ☐ Occ. Safety ☐ Other (Itemize):

COMMENTS:

DATE AUTHORIZED: _____ Signed: _____ University Representative
PO&M: _____

COMPLETION DATE: _____

COMMENTS:
(Unknown Utilities Encountered, Disruptions, Successes, Weather, etc.)

SIGNED: _____

Copies to: University Consultants, PO&M, Fire, Telecom, File, Others:

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SECTION 01 74 00

CLEANING

PART I - GENERAL

1.01 SECTION INCLUDES

A. Construction Cleaning.

B. Requirements for cleaning during progress of Work, at Substantial Completion of Work and at Acceptance of Work.

C. Disposal of waste materials, debris and rubbish during construction.

1.02 RELATED SECTIONS

A. General Conditions of the Contract: Cleanup.

B. Additional Requirements: Cleaning for specific products or elements of Work are described in Specification Sections describing that Work.

C. Section 015610 Airborne Contaminants Control have procedures and practices that shall be implemented and followed by the **Contractor** for this project.

D. Section 013900 Green Building Policy Implementation: Waste Management Program

PART II - PRODUCTS

2.01 MATERIALS

A. Use only those cleaning agents and materials that will not create hazards to health or property and that will not damage surfaces.

B. Use only those cleaning agents, materials and methods recommended by manufacturer of the material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning agent manufacturer.

2.02 EQUIPMENT

A. Provide covered containers for deposit of waste materials, debris, and rubbish.

B. Provide at each entry point to the Work, and at other areas as directed by University's Representative, a clean room sticky mat. Replace mats daily or as requested by University Representative.

PART III - EXECUTION

3.01 CLEANING

A. Construction Cleaning: During Construction, maintain buildings, premises and property free from waste materials and rubbish. Dispose of such waste and debris at reasonable intervals off of University property.

1. Maintain areas under **Contractor**'s control free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to closing such spaces.

    a. All horizontal surfaces above ceilings shall be cleaned prior to ceiling closer.

3. After every concrete placement clean all wet concrete from all surfaces.

    a. Interior and exterior

4. Clean interior areas daily to provide suitable conditions for Work. Remove debris from areas of work on a daily basis at a minimum, or more often as required to provide suitable conditions for work.

5. Broom clean with sweeping compound or HEPA Vacuum interior areas prior to start of surface finishing, and continue cleaning on an as needed basis.

6. Control cleaning operations so that dust and other particles will not adhere to wet or newly coated surfaces.

7. Provide a mat, as specified above, for project entrances and exits. Item to be of sufficient size to allow personnel exiting project site to clean debris and dust from shoes. Tracking dust and debris through working areas of hospital and/or related buildings is not acceptable.

8. Any dust or debris tracked out of the construction site, either by foot traffic or by debris hauling vehicles shall be cleaned by the **Contractor**. If the dirt or other debris is determined by the University's Representative to from the **Contractor**'s activities at the jobsite it shall be cleaned in a timely manner regardless of how far from the site it is.

B. Conduct cleaning and disposal operations in compliance with Waste Management Program per 013900 and all applicable codes, ordinances, regulations, including anti-pollution laws.

3.02 SUBSTANTIAL COMPLETION CLEANING

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

B. At roof areas remove all unused materials and construction waste including but not limited to screws, nails, fasteners, sheet metal cuttings, scrapes, oil, grease and adhesive. Wash down roof horizontal and vertical surfaces. Clean out all debris at roof drains.

C. Clean walkways, driveways and streets by thorough brooming and wash-down.

D. Clear debris from storm drainage lines and ways, leaving site ready for stormy weather.

E. Rake landscaped areas clean.

F. Remove waste and surplus materials, rubbish and temporary construction facilities, utilities and controls.

G. Disinfect containment and protection areas as directed by University Representative.

H. For Airborne Contamination areas: Construction cleaning use wet cleaning methods and HEPA-filtered vacuum cleaners are required to minimize release of airborne contaminants. Contain waste materials, debris and rubbish.

3.03 FINAL COMPLETION CLEANING

A. Complete final cleaning before submitting final Application for Payment.

B. Employ professional building cleaners to thoroughly clean building immediately prior to final inspection.

C. Remove the following but not limited to concrete splatters, paint splatters, pencil marks, pen marks, chalkline marks, tape, protective films & coatings, grease, mastic, adhesives,

dust, dirt, stains, fingerprints, labels, and other foreign materials from all sight-exposed interior and exterior surfaces.

D. Restore damaged or marred surfaces.

E. Remove dust from all horizontal surfaces not exposed to view, including light fixtures, ledges and fixture lenses.

F. Clean and polish all glass, mirrors, and bright metal work. Clean and disinfect all plumbing fixtures.

G. Damp wash all resilient flooring. Waxing of resilient flooring shall be done by the University.

H. Thoroughly sweep all floors and vacuum all carpets.

I. Cleaning of Work provided by University under separate contracts, will not be required except if soiled by construction activities under this Contract.

J. Thoroughly clean and polish all resilient flooring, metal and plastic surfaces; remove labels and protective coatings.

K. Replace filters and clean heating and ventilating equipment used for temporary heat and ventilation.

L. Remove waste material or equipment that has been damaged, touch up and /or repair exposed areas; such repairs to be approved by University's Representative.

M. Should final cleaning be inadequate, as determined by University's Representative, and **Contractor** fails to correct conditions, University's Representative may order thorough cleaning and deduct the cost from Final Payment.

3.04 FINAL COMPLETION SITE CLEANING

A. Broom clean exterior paved surfaces. Rake clean other surfaces of the grounds.

B. Power Wash, Hose down and scrub where necessary all concrete and walks dirtied as a result of the construction work. Thoroughly remove mortar droppings from all walks and pavements.

C. Remove from the site all tools, equipment, construction waste, unused materials, excess earth, and all debris resulting from the Work.

3.05 DISPOSAL

A. Conduct cleaning and disposal operations in compliance with all applicable codes, ordinances, regulations, including anti-pollution laws.

B. Do not bury or burn rubbish or waste material on University premises.

C. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.

D. Remove waste materials, debris, and rubbish from site and dispose of off-site.

3.06 INSPECTION

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

END OF SECTION 01 74 00

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SECTION 01 75 00

STARTING AND ADJUSTING SYSTEMS

PART I - 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

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SECTION 01 76 00

PROTECTION of EXISTING and INSTALLED CONSTRUCTION

PART I - GENERAL

1.01 SECTION INCLUDES

A. Protection for Products Including University Provided Products, After Installation.

B. Protection of Existing Utilities, Interference and Underground Structures.

C. Protection of Existing Structures and Work adjacent to new construction and demolition.

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

B. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION

C. Section 015100 – TEMPORARY UTILITIES

1.03 EXISTING UTILITIES

A. Known Utilities: Known existing utilities are shown on Contract Drawings in approximate locations. **Contractor** shall exercise care in avoiding damage to existing facilities. **Contractor** shall be responsible for repair of same if damaged through **Contractor**'s action. Hand excavation shall be utilized when digging in close proximity to existing utilities. University does not guarantee that all utilities or obstructions are shown, or that locations indicated are accurate.

B. As part of the Contract Work the investigation and excavation to locate existing utilities and underground structures shall be as follows, **Contractor** shall assume the existing known utility is within a 5 feet zone on either side of the location indicated on the Contract Documents. If the existing known utility is not located within a 5 feet zone on either side of the location indicated on the Contract Documents, the **Contractor** shall immediately notify the Universities Representative. The **Contractor** shall continue excavating until the existing utility is located. The **Contractor** shall be compensated for any additional excavation beyond the 5 feet zone on either side of the existing utility per 1.03D.

C. Electrical Equipment: No work shall be performed on energized electrical equipment unless scheduled with University's Representative. University reserves right to specify specific conditions for all work involving energized high voltage electrical equipment and its scheduled modification proposal.

D. Uncovering Facilities: Prior to any earthwork for new construction, **Contractor** shall uncover all existing piping where crossings, interferences or connections are shown on Contract Drawings, from one (1) foot below proposed construction limit to the existing ground surface. Any variation in actual elevations and indicated elevations shall be brought to University's Representative attention. If **Contractor** does not expose all existing utilities, **Contractor** shall not be entitled to additional compensation for work necessary to avoid unknown interferences.

E. Interferences: If interferences occur at locations other than general locations shown on Contract Drawings, and such utilities are damaged before such locations have been established, or create an interference, **Contractor** shall immediately notify University's Representative and a method for correcting said interference shall be supplied by university. Payment for additional work due to interferences not shown on Contract Drawings shall be in accordance with the General Conditions of the Contract. Cost of repair to damaged utilities shall be deducted from the Contract Sum.

F. Accuracy of Drawings: Drawings showing location of equipment, piping, etc. are diagrammatic and job conditions will not always permit installations in locations shown. When a conflict situation occurs, immediately bring to attention of University's Representative for determination of relocation.

G. Deviations from Drawings: Information shown relative to existing power and signal service is based upon available records and data but shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made at no change to the Contract Sum.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 PROTECTION AFTER INSTALLATION

A. Installed Equipment and Materials: Adequately protect all installed equipment and materials until completion and acceptance by University's Representative.

B. Existing Facilities: All existing areas, improvements and facilities shall be protected from damage of any type resulting from operations, equipment or workers of **Contractor** during the construction process.

C. Subsequent Operations: Protect installed products and control traffic in immediate area to prevent damage from subsequent operations.

D. Traffic Areas: Provide protective coverings at walls, projections, corners, and jambs, sills, and soffits of openings in and adjacent to traffic areas.

E. Elevators: Cover walls and floors of elevator cabs, and jambs of cab doors, when elevators are used by construction personnel. Protect the elevator call buttons, switches, communication devices, lights, thresholds and other components.

F. Moisture and Humidity Protection: Protect all new installed work and existing work per the manufacturer’s requirements from moisture or humidity damage including but not limited

to stored materials, finishes, gypsum board, insulation, doors, casework, millwork, equipment and all other building components.

G. Finished Floors: Protect finished floors and stairs from dirt, wear, and damage:

1. Secure heavy sheet goods or similar protective materials in place, in areas subject to foot traffic.

2. At all transitions to adjacent areas not under construction.

3. Lay rigid materials in place in areas subject to movement of heavy objects and where storage of products will occur.

H. Waterproofed and Roofed Surfaces:

1. Restrict use of surfaces for traffic of any kind, and for storage of products.

2. When an activity is mandatory, obtain recommendations for protection of surfaces from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.

3. No Construction work shall be conducted on any unprotected roof weather new or existing.

4. All pathways to work on the roof shall be protected.

I. Lawns and Landscaping: Restrict traffic of any kind across planted lawn and landscaped areas.

J. Adjacent Facilities: Care shall be exercised to prevent damage to adjacent facilities including walks, curbs, and gutters. Adequate protection shall be placed where equipment will pass over such obstructions, and facilities damaged by construction operations shall be removed and replaced at **Contractor's** expense.

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

A. The **Contractor** shall protect existing in place work at the exterior and interior, including but not limited to finishes, materials, products, utilities, fixtures, and equipment adjacent to new construction and demolition. Any existing in place work at the exterior and interior that is damaged by the **Contractor** shall be repaired or replaced at no extra cost to the University.

B. Overloading: **Contractor** shall be responsible for overloading any part or parts of structures beyond the calculated capacities of the design. Placing materials, equipment, tools,

machinery, or any other item shall be done with care to avoid overloading. No loads shall be placed on floors or roofs before they have attained their permanent and safe strength.

C. Damaged Work: All damaged work shall be replaced, repaired, and restored to its original condition without change to the Contract Sum. Repair or replace all damaged work promptly as directed by University's Representative.

D. Damaged Utilities: Where existing utilities are damaged or disrupted on account of any act, omission, neglect, or misconduct of the **Contractor** in the manner or method of executing the Work, or due to non-execution of work, such damage shall be immediately repaired to maintain operation regardless of the time of occurrence.

E. Temporary Construction: Provide temporary construction necessary for protection of building and its parts. Close in buildings as soon as possible to protect from weather and vandalism. Protect existing buildings and controlled temperature areas from damage.

F. Doors and Casework: Protect doors, millwork and mill counters and cases and hardware from damage, including abrading and scratching of finishes. Protect doors and frames and hardware from mechanical damage and damage to anodic coatings.

G. Protective Coatings: Remove protective coatings, etc., as required to leave work in condition for painting and finishing, final cleaning, etc.

H. Exterior Work: Protect all exterior work, including existing asphalt paving and landscaping and buildings.

END OF SECTION 01 76 00

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Project Closeout Procedures

B. Contract Closeout Procedures

C. Punch List of Incomplete Work or Corrections

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES: Administrative general requirements for submittals.

C. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION

D. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS: Removal of Controls.

E. Section 017400 – CLEANING: Final Cleaning.

F. Section 017800 – CLOSEOUT SUBMITTALS

1.03 FINAL COMPLETION ACTIONS

A. On Application for Payment that coincides with date Substantial Completion is claimed, show 100% completion for portion of Work claimed substantially complete.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

C. Notify the University’s Representative fourteen (14) calendar days prior to the Project being ready for permanent cores and keying.

D. Complete start-up testing and Commissioning of systems, and instruction of University personnel. Remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.

1.04 SUBSTANTIAL COMPLETION REVIEW

A. Preliminary Punch List Review:

1. **Contractor** shall provide an electronic file as indicated in Item 1.04, C., (Preliminary Punch List) of items not installed, to be completed, not functioning correctly or to be corrected. The list shall include the anticipated dates of when the work is to be installed, completed or corrected.

2. Organize the List per Item 1.04, C.

3. List shall identify items by location (e.g., room number and name) and consecutive number (e.g., 307-5 might identify item 5 in room 307, Roof-4 would identify item 4 on Roof).

4. Segregate architectural, plumbing, HVAC and electrical Work on separate lists.

5. University's Representative and **Contractor** shall conduct a brief walk-through of Project to review scope and adequacy of list.

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

1. Submit to University's Representative written certification that:

a. Contract Documents have been reviewed.

b. All portions of Work have been carefully inspected.

c. Work is complete in accordance with Contract Documents.

d. Equipment and systems have been commissioned, tested, adjusted and balanced and are fully operational.

e. Indicate Operation of systems that have been demonstrated to University personnel and which systems have not been demonstrated to University personal.

f. Work is ready for University's Consultant's Substantial Completion review.

2. Provide minimum fourteen (14) calendar days' notice to University's Representative prior to desired date for Punch List review.

C. Organization of List (Punch List):

1. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by **Contractor** that are outside the limits of construction.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Format Requirements: Provide the following:

a. Organized electronic file that is able to be filtered or queried by the following categories:

1) **Contractor** or Subcontractor

2) Building Area/Floor if applicable

3) Room Number or specific interior or exterior area.

4) Photo Number if applicable

5) Open or Closed

6) Columns for use by University’s Representative

a) Responsible Design Consultant

7) Comments

b. Other Punchlist Software may be used if approved by the University’s Representative.

c. Include the following information at the top of each page:

1) Project name and Number.
2) Date.
3) Name of University's Representative.
4) Name of **Contractor**.
5) Page number.

D. Punch List Review: University's Representative and University's Consultants as may be required, will attend a Contract closeout review, and conduct a walk-through of Project to review **Contractor**'s list of items to be completed and corrected (Punch List). **Contractor** and University's Consultant shall note deficiencies, if any.

1. **Contractor** shall prepare list and record additional items as University's Representative may determine require completion and correction from walk-through.

a. If deficiencies are noted University's Representative and University's Consultant shall promptly notify **Contractor** in writing, listing observed deficiencies.

b. If no deficiencies are noted, or when noted deficiencies are removed from the Punch List, University's Representative shall promptly notify **Contractor**.

2. **Contractor** shall edit the electronic file and distribute list with University's Representative and University's Consultant's additions.

3. **Contractor** shall remedy deficiencies.

4. Costs of additional visits to site by University's Consultants to review completion and correction of Work shall be deducted from the Contract Sum.

E. Uncorrected Work: Refer to requirements specified in SECTION 014500 – QUALITY CONTROL regarding Contract adjustments for non-conforming work.

F. Cleaning and Clearing: Prior to Substantial Completion review, execute cleaning and clearing site of temporary facilities and controls, as specified in SECTION 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS and SECTION 017400 CLEANING

G. Testing and Inspection: Prior to Substantial Completion review, complete all tests and inspections and submit applicable reports and approvals. Provide commissioning of building systems per Section 013900 GREEN BUILDING POLICY IMPLEMENTATION.

1. Complete materials tests and inspections.

2. Complete commissioning, testing, inspection, balancing, sterilization and cleaning of plumbing and HVAC systems.

3. Complete commissioning, testing and inspection of electrical system.

4. Complete commissioning and operational tests of equipment.

5. IF HCAI PROJECT: Submit electronic file of **Contractor**'s Final HCAI Verified Reports to University's Representative certifying completion of the Work in conformance with the Contract Documents. Report forms will be supplied by University's Representative.

H. Acceptance of the Work shall not relieve **Contractor** of any responsibility for defects that develop during the guarantee period and are caused by **Contractor**'s failure to perform work in accordance with requirements of Contract Documents.

1.05 FINAL COMPLETION 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 - NOT USED
4. Changes under unit prices - NOT USED
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

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SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Equipment Data

B. Operation and Maintenance Instructions

C. Instruction of University personnel

D. Schedule of Submittals

E. Spare Parts and Maintenance Materials

F. Guarantees, Warranties, Bonds, Service and Maintenance Contracts

G. Project As-built Documents

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

B. Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

C. Administrative general requirements for submittals.

D. Section 013900 – GREEN BUILDING POLICY IMPLEMENTATION

E. Section 014500 – QUALITY CONTROL: Manufacturer's tests and inspections as a condition of warranty.

F. Section 014550 – INSPECTION AND TESTING OF WORK

G. Section 016100 – PRODUCT REQUIREMENTS

H. Section 017700 – CLOSEOUT PROCEDURES

1.03 FILE FORMATS

A. All printed documents submitted per this section shall be in PDF format

1. The PDF files will be unlocked and searchable.
2. All PDF documents will be bookmarked.
3. The exception to electronic format for As-Built drawings will be noted in the specific specification section where they are required.

B. Digital Photography

1. All files will be submitted in JPEG

1.04 EQUIPMENT DATA AND OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Preparation of data shall be done by persons:

1. Trained and experienced in maintenance and operation of described products.
2. Familiar with requirements of this Section.
3. Skilled in technical writing to extent required for communication of essential data.
4. Skilled as drafters competent to prepare required drawings

B. O&M Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at time of Section Submittals. Submit reviewed manual content formatted and organized as required by this Section. Prepare in the form of a data and instructional manual.

C. Submit PDF electronic files of operation and maintenance manuals. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the University. The exception to electronic format will be indicated in the specific specification section requiring hard copies of the manual.

1. Name each indexed document file in composite electronic index with applicable item name. Include a completed electronically linked operation and maintenance directory.

a. List Project title and Project number and particular building as applicable.

b. Enable inserted reviewer comments on draft submittals.

2. Organization: Arrange content by systems under Section numbers and sequence in accordance with the Project Specifications Table of Contents.

D. Table of Contents, Each Volume: Provide title of Project, Project number, with names, addresses, and telephone numbers of University's Representative, as applicable, and **Contractor**, including name of contact person. Provide schedule of products and systems, indexed to content of the volume.

1. For each Product or System: List names addresses and telephone numbers of subcontractor, original supplier and manufacturer, as applicable, including name of contact person. Include name and address of local source of supplies and replacement parts.
2. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete information not applicable.
3. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project As-Builts Documents as maintenance drawings.
4. Additional Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 014500 – QUALITY CONTROL.
5. Warranties and Bonds: Include in each applicable section.

E. Manual for Materials and Finishes:

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

F. Manual for Equipment and Systems

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

manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

10. Control Data: Provide as installed control diagrams by controls manufacturer.

11. Piping Data: Provide **Contractor**'s coordination drawings, with color piping diagrams as installed. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

12. Design Data: Provide a listing in table of Contents for design data, with tabbed binder divider page and space for insertion of data.

13. Reports: Include test and balancing reports as specified.

14. Additional Requirements: As specified in individual Specification Sections.

G. Instruction of University's Personnel: Instruct University designated personnel to their full and complete understanding, procedures necessary to operate and maintain equipment and systems on continuing basis. Provide training of staff.

1. Schedule: Before final inspection, instruct University designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months of completion.

2. Basis of Information: Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

3. Instructional Material: Prepare and insert additional data in the manual when need for such data becomes apparent during instruction.

H. Equipment Data and Operation and Maintenance Instructions Submittals:

1. Submittals: Comply with administrative requirements specified in SECTION 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

2. Preliminary Draft O&M Submittal: Submit electronic files of each manual at least **[180]** calendar days before commencing demonstration and training. University's Representative will review draft and return with comments.

   a. The comments or corrections shall be incorporated into the Final O&M submittal.

   b. Correct or revise each manual to comply with the University’s Representatives comments. Submit electronic copies of each corrected manual within **[15]** calendar days of receipt of University’s Representative’s comments.

   c. University’s Representative will notify the **Contractor** when the edits have been accepted for incorporation into the final O&M submittal.

3. Advance Submittals: For equipment, or component parts of equipment to be put into service during construction and operated by University, submit documents within ten (10) calendar days after equipment approval.

4. Final O&M Submittal: After completion of instruction of University operation and maintenance personnel and final inspection, revise content of documents to include additional information deemed necessary from instruction experience of University's personnel and any changes made during construction. Submit each

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

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

1.05 SPARE PARTS, EXTRA STOCK AND MAINTENANCE MATERIALS

A. Products Required: Where called for in Contract Specifications, deliver to University's Representative, materials, etc., for use in maintenance work. Provide list of materials delivered to University's Representative, indicating date and acceptance by University's Representative.

1. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual Sections to be provided to University's Representative, in addition to that required for completion of the Work.

2. Products supplied shall be identical to those installed in the Work. Include quantities in original purchase from supplier to avoid variations in manufacture.

3. Provide itemized list of all spare parts, materials and transmittal to the University's Representative for acceptance.

B. Storage, maintenance: Store products with products to be installed in the Work, as specified in SECTION 016100 – PRODUCT REQUIREMENTS: Product Storage and Protection.

C. Delivery to site: Prior to final payment, deliver and unload spare products to project site. Coordinate with University's Representative and obtain receipt. University will handle and store products.

1.06 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of Documents: Include a table of contents for each O&M and emergency, operations listed per CSI Specification number.

2. List of Systems and Subsystems: Include references to operation and maintenance manuals that contain information about each system.

3. List of Equipment: List equipment for each system, organized by system. For pieces of equipment not part of system, list separately.

4. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists,

assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

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

1.07 MAINTENANCE AGREEMENTS

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

1. Provide all Maintenance Agreements in PDF form.

a. Submit individual files for each Maintenance Agreement with a directory assembled by CSI division.

1) Combine all project Maintenance Agreements including the directory into one PDF for record.

2) Files will be formatted for printing with a footer identifying the CSI number and UC Davis Health project number.

3) There will be a front cover to the file that contains all project information including the **Contractor** contact information.

1.08 EMERGENCY MANUALS

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

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

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

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of University's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.09 WARRANTIES AND GUARANTEES

A. Warranties and Guarantees, general: Guarantees from subcontractors shall not limit **Contractor**'s warranties and guarantees. Whenever possible, **Contractor** shall cause warranties of subcontractors to be made directly to university. If such warranties are made to **Contractor**, **Contractor** shall assign such warranties to university prior to final payment. When equipment and products, or components thereof, bear a manufacturer's warranty or guarantee that extends the time period of **Contractor**'s warranty or guarantee, so state in the warranty or guarantee.

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

9. University Recourse: Written warranties made to the University are in addition to implied warranties, and shall not limit duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which University can enforce such other duties, obligations, rights, or remedies.

10. Rejection of Warranties: University reserves right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

11. University reserves right to refuse to accept work where a special warranty, or similar commitment is required, until evidence is presented that entities required to countersign commitments are willing to do so.

12. When designated portion of Work is completed and occupied or used by separate agreement with **Contractor** during the construction period, submit properly executed warranties to University's Representative within fourteen (14) calendar days of completion of that designated portion of the Work.

13. Submit written guarantees, in the form contained at end of this Section.

B. Form of Warranty or Guarantee: All written warranties and guarantees, excepting manufacturers' standard printed warranties and guarantees, shall be submitted on **Contractor**'s, subcontractor's, material supplier's, or manufacturer's own letterhead, addressed to University. Warranties and guarantees shall be submitted in duplicate and complying with the form letter following. Warranty and guarantee letters shall be signed by all responsible parties and by **Contractor** in every case, with modifications only as approved by University to suit the conditions pertaining to the warranty or guarantee.

C. Submission requirements:

1. **Contractor** shall collect and assemble required warranties, guarantees, bonds, and service and maintenance contracts. Provide PDF electronically signed or signed and scanned copies of each. Organize documents into an orderly sequence based on the table of contents of the Project Manual CSI divisions.

2. Table of Contents: Provide PDF electric file with links to individual warranty sections. Include the following information.

   a. Product or Work item.

   b. Product or work suppliers firm name, address, telephone number and name of principal.

   c. Scope of guarantee, bond, service or maintenance agreement.

   d. Date of beginning of guarantee, bond, service or maintenance contract.

   e. Duration of guarantee, bond, service or maintenance contract.

   f. **Contractor**'s name, address, telephone number and name of principal.

   g. Provide information for University personnel:

      1) Proper procedure in case of failure.

      2) Circumstances that might affect validity of guarantee or bond.

D. Warranty Submittal

1. Provide all warranties in PDF composite electronically indexed files.

a. Submit individual files for each warranty with a directory assembled by CSI division.

1) Combine all project warranties including the directory into one PDF for record

2) Files will be formatted for printing with a footer identifying the CSI Number and UC Davis Health Project Number.

3) There will be a front cover to the file that contains the title “WARRANTY, GUARANTEE AND BOND” as well as all project information including the **Contractor** contact information. Title of Project and UC Davis Health Project Name and Number.

4) Coordinate copies of each warranty to be included in operation and maintenance manuals.

5) Final Submittal shall be incorporated into one PDF, bookmarked and searchable document.

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

1.10 AS-BUILT DOCUMENTS

A. Definitions:

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

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

1. Trained and experienced in the maintenance, preparation, and submittal of As-Built Documentation.

2. Familiar with requirements of this Section.

C. As-built Documents Content:

1. As-built Drawings and Specifications
2. As-built Schedule
3. Miscellaneous As-Built Submittals

D. As-Built Drawings and Specifications: Provide a complete set of As-Built Drawings and Specifications, showing and noting every change from the Contract Set, including but not limited to:

- Changes made in response to RFI's
- Amended Construction Documents (ACD) and related RFI's
- Change Orders/Field Orders and related RFI's.
- Architect's Supplemental Information (ASI) and related RFI's.
- Changes to locations, including access panels, windows, doors, plumbing, etc.
- Changes caused by obstructions and the obstructions notated
- Changes made in response to inspections
- Final dimensions
- Deferred Submittals (see "Miscellaneous As-Built Submittals" below)
- Shop Drawings (see "Miscellaneous As-Built Submittals" below)
- Final product selections

1. Format Requirements:

a. Provide in PDF format with bookmarks. All annotations shall be neat and legible.

b. File naming conventions:

1) Drawings: YY_MMDD_University's Project Number_As-Built_Dwgs

2) Specifications: YY_MMDD_University's Project Number_As-Built_Spec

c. Provide text (preferably 1/4" or larger) on each drawing and on the cover of the specifications indicating the submission date, the University's Project Number, and the term "As-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:

1) Provide a two-digit numerical suffix that starts with .01 and ascends for every supplemental sheet:
Example: If the supplemental sheet contains sketches that describe changes to the hypothetical sheet “A1-01” the first supplemental sheet will be numbered “A1-01.01”.

2) The sheet name and number are to be similar in text size and location to the sheet being supplemented.

3) Include supplemental sheets in bookmarks.

E. As-Built Schedule: Provide As-Built schedule per SECTION 013200 CONTRACT SCHEDULES

1. Format Requirements:

a. Schedule to be in PDF format.
b. File naming conventions:

1) YY_MMDD_ University’s Project Number_As-Built_Schedule

F. As-Built Shop drawings:

1. Format Requirements:

a. File naming convention for shop drawings:
1) YY_MMDD_ University’s Project Number_ShopDwg_Spec Section Number

G. As-built Documents Submittal: Submit all As-Built Documents together after Final Completion and in accordance with SECTION 017700 CLOSEOUT PROCEDURES. Allow 10 business days for initial review and for each resubmittal.

1.11 AS-BUILT PRODUCT DATA

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; free from any liens, claims, and security interests; and has been completed in accordance with Specification SECTION_____ and the other requirements of the Contract.

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

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

SUBCONTRACTOR

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

Contractor License Classification & Number: _____

Address:_____

Telephone Number: _____

CONTRACTOR

Signed:_____ Title: _____

Typed Name: _____

Name of Firm:_____

Contractor License Classification & Number: _____

Address:_____

Telephone Number: _____

REPORT OF WORK REQUIRED BY WARRANTY

To:	Michael Gomez, University Representative
From:	

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

Prepared by: _____ _____ _____
(Print Name) Signature Date

In accordance with the terms and conditions of the Contract, the **Contractor** has agreed that, if at any time within 12 months after the date of the guarantee the **Contractor** receives notice from University that the aforesaid portion of the Work is unsatisfactory, faulty, deficient, incomplete, or not in conformance with the requirements of the Contract, the **Contractor** will, within 10 days after receipt of such notice, correct, repair, or replace such portion of the Work, together with any other parts of the Work and any other property which is damaged or destroyed as a result of such defective portion of the Work or the correction, repair, or replacement thereof; and that it shall diligently and continuously prosecute such correction, repair, or replacement to completion.

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

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SECTION 01 82 00

DEMONSTRATION AND TRAINING

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

A. Section 017800 – CLOSEOUT SUBMITTALS

B. Section 018100 – PLUMBING/HVAC TESTING PROCEDURES

1.03 SUBMITTALS

A. Submit preliminary schedule for University Representative approval, listing times and dates for demonstration of each item of equipment and each system, in writing, minimum of thirty (30) calendar days prior to activities.

B. Submit reports and videos within (14) calendar days after completion of demonstrations and instructions. Give time and date of each training session, and hours devoted to training with a list of persons present and the corresponding video.

1.04 QUALITY ASSURANCE

A. Equipment installed under Contract shall operate quietly and free of vibration. Adjust, repair, balance properly, or replace equipment producing objectionable noise or vibration in occupied areas of building. Provide additional brackets, bracing, etc., to prevent such noise or vibration. Systems shall operate without humming, surging or rapid cycling.

B. University will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon time.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 PREPARATION

A. Verify equipment has been inspected, commissioned, and put into operation.

B. Send approved pdf version of completed operation and maintenance manual 7 calendar days prior to training.

3.02 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of equipment and systems to University two (2) weeks prior to date of final inspection. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months of completion.

B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance. Display on a video screen and demonstrate the use of bookmarks and searches to find information being sought.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

END OF SECTION 01 82 00

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SECTION 01 91 00

COMMISSIONING

PART I - GENERAL

1.01 SUMMARY

A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; those systems are efficient, cost effective and meet the University's Project Requirements and operational needs; that the installation is adequately documented; and that the operations staff are adequately trained. This is achieved by a full understanding of all building systems through construction, acceptance and warranty period with actual verification of performance. It also establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.

B. The Commissioning process does not relieve responsibility of the **Contractor** to provide a finished and fully functioning Project. The **Contractor** and Subcontractors provide the quality control for installation and start-up of the building systems.

C. The specified commissioning activities shall demonstrate compliance with the University, LEED and California Code Commissioning requirements.

D. Commissioning is a condition of the Contract and shall not be excluded from the base bid.

E. Commissioning requirements extend to all alternates and change orders, as well as all subcontracts and purchase orders for work under the **Contractor**'s control.

F. Related Documents:

1. Division 00 Procurement and Contracting Requirements, apply to this Section.

2. Drawings and general provisions of Contract, and other Division 01 Specification Sections, apply to this Section.

3. Technical Divisions of the Specifications apply to this Section.

1.02 DEFINITIONS

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

B. Action Item: Any issue that requires a response, completion, corrective or additional work, or any other action. Examples include a Request for Information (RFI), a work directive, a clarification request, a to-do item, an identified deficiency, or any other like item. Actions Items must be categorized as appropriate.

C. Action List: This is a list that is maintained and updated by the CxA that includes all Action Items that relate to Cx activities.

D. Commissioning (Cx): The process of ensuring that all building systems perform interactively according to the design intent and that the system operations are efficient and cost effective and meet the University's functional needs.

E. Commissioning Agent (CxA): The individual retained by the University who will oversee the Cx process, develop and stipulate many of the Cx requirements (including FPTs), manage the Cx process, and ensure and verify that systems and equipment are installed, and tested to meet the University's requirements.

F. Commissioning Coordinator (CC): The **Contractor** shall provide a Commissioning Coordinator. The CxA, the University's Representative and the CC will comprise a commissioning management team. While the CxA leads the overall commissioning process, the CC is responsible for managing contractors in their day-to-day performance of the specified commissioning work. The CC is an employee of the **Contractor** who is regularly and frequently on site. Qualifications for the Commissioning Coordinator include experience and excellent abilities to schedule, coordinate and manage subcontractors. The following tasks are some of the critical items included in the CC's scope of work:

1. Integrating the specified commissioning activities into the overall contract construction schedule, updating the schedule, and providing three-week look-ahead schedules showing the upcoming commissioning related activities.

2. Providing all commissioning submittals to the University's Representative and CxA.

    a. O&M Manuals per Division 017700 Close-out Procedures and 017800 Close-out Submittals

3. Coordinating University training and ensuring that training is provided in accordance with the Division 017700 Close-out Procedures and the technical specifications.

4. Ensuring that subcontractor and supplier review and complete the CxA provided FPT procedures and forms then submitted in accordance with the specifications. This includes providing written comments (even if no exception is taken) regarding issues pertaining to safety, equipment protection/warranty and appropriateness of the procedure for the systems as provided from all required FPT participants for each FPT.

5. Coordinating development and submittal of specified flushing, cleaning and start-up procedures and ensuring that these procedures are completed, and documentation is submitted.

   a. Providing test reports and progress reports in accordance with the 017800 Close-out Submittals, commissioning, and technical specifications.

6. Managing the **Contractor** participation in the FTP process in accordance with the commissioning specifications.

7. Managing the **Contractor** participation in resolution of issues identified during pre-commissioning meetings and during the commissioning process.

8. Ensuring that subcontractors perform preliminary testing to verify readiness for final FPT demonstrations, submitting documented verification that systems will pass functional tests with acceptable results as documented in the FPTs and coordinating the demonstration of the FPTs to the University and the CxA.

9. Coordinating repeat FPTs that fail due to contract deficiencies until acceptable results are achieved and managing the reimbursement of the University's costs for repeated tests in accordance with the commissioning specifications.

G. Commissioning Plan: This is a detailed document prepared and maintained by the CxA that describes the entire commissioning process.

H. Commissioning Specifications (Cx specs): Includes the Cx specification section and Cx-related subsections of other specifications. All **Contractor** requirements relating to Cx.

I. Commissioning Team: The parties involved in the commissioning process for any given system. The Cx Team will include a core group involved with all systems. This core group will typically include the CxA, the University's Cx coordinator, and **Contractor** CC and/or MEP Coordinator. At any given point the team may include the project manager, members of the design team, the project inspector, product representatives, and operation and maintenance personnel.

J. **Contractor**: As used herein, **Contractor** is a general reference to the installing parties and can therefore refer to the **Contractor**, the subcontractors, or vendors as inferred by its usage.

K. Construction Phase: Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. **Contractor** and subcontractors complete the installation complete start-up documentation, submit O&M information, establish trends, and perform other applicable requirements to get the systems started. The Construction Phase will generally end upon completed start-up and TAB of systems and equipment.

L. Contract Documents: The documents governing the responsibilities and relationships between the parties involved in the construction of the project including, but not necessarily limited to, the agreement/contract, construction plans and drawings, specifications, addenda, and change orders.

M. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.

N. Functional Completion: A milestone that marks the completion of the Acceptance Phase and successful documentation of the FPTs by the CxA.

O. Functional Performance Testing (FPT): This process verifies that the systems within the commissioning scope function in accordance with the Contract Documents, the University's design intent and the Design Team's Basis of Design. The process includes the documented testing of the systems under actual and simulated operating conditions. Functional Performance Test (FTP) procedures are detailed instructions that allow experienced system technicians to perform the FPTs with repeatable results. The repeatability of the procedures and results validate the tests. Final performance testing of systems will begin only after the **Contractor** certifies that such systems are completely installed and ready for functional testing and after the CxA has completed the subsequent installation verification process for the systems to be tested.

P. Installation Verification Process: This process includes the on-site review of related system components for conformance to the Contract Documents. Upon receipt of the completed **Contractor**'s System Readiness Manual, the CxA will conduct this review and verify system readiness for final functional testing procedures. The CxA will document issues identified during this process and assign them to the appropriate party for resolution.

Q. MEP Coordinator: **Contractor**'s staff member who is responsible for all MEP equipment and system installation, coordination, and start-up is the primary contact for the Cx Agent and shall be responsible to organize and lead the start-up and commissioning meetings, tracks response to Action Items from Cx Agent and generate minutes.

R. Ready to Commission statement: The subcontractor's written statement, through the System Readiness Checklist (SRC),that the equipment or system described has been completely installed, started, and tested to ensure that it has met all the requirements of the contract documents and is ready for commissioning.

S. Start-up: Refers to the quality control process whereby the **Contractor** verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the start-up checklists, energizes the device, verifies it is in proper working order and ready for dynamic testing, and completes the start-up tests.

T. System Readiness Checklists (SRCs): These checklists are provided by the CxA and include equipment installation and start-up items specified to be performed and verified by the **Contractor**. These checklists shall be compiled along with associated start-up forms by the **Contractor** to create the **Contractor**'s System Readiness Plan. They shall be completed during installation and returned to the CxA as components of the **Contractor**'s System Readiness Manual prior to the final CxA installation verification and functional performance testing process.

U. System Readiness Manual: This document includes, for each system within the commissioning scope of work, completed and signed versions of each form submitted by the **Contractor**'s .

V. System Readiness Plan: This document shall be completed by the **Contractor** and submitted to the CxA prior to the final installation verification and functional performance testing process. By submitting these completed forms, the **Contractor** signals that the relevant systems are installed, operational and will meet functional testing acceptance criteria. The System Readiness Plan is compiled by the **Contractor** and includes, for each system within the commissioning scope of work, the System Readiness Checklists provided by the CxA, followed by the associated **Contractor**'s Start-up and Test Forms. The **Contractor** System Readiness Plan shall be submitted to the CxA for review and approval prior to installation of the systems.

1.03 REFERENCES

A. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE):

1. ASHRAE Guideline 0-2013, The Commissioning Process

2. ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for The Commissioning Process.

3. ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems

B. US Green Building Counsel (USGBC), Leadership in Energy and Engineering Design (LEED):

1. Reference Guide for the version of LEED pursued by project

C. California Building Standards Code (California Code of Regulations, Title 24):

1. Part 6, Building Energy Efficiency Standards for Residential and Nonresidential Buildings

2. Part 11, CALGreen

1.04 SYSTEMS TO BE COMMISSIONED

A. All systems and equipment identified in the contract documents as having quality assurance or acceptance testing requirements are included in SYSTEMS TO BE COMMISSIONED by reference.

B. All systems and equipment identified in the contract documents as requiring startup are included in SYSTEMS TO BE COMMISSIONED by reference.

C. All systems and equipment identified in the contract documents requiring training are included in SYSTEMS TO BE COMMISSIONED by reference.

D. Commissioning shall be system based.

1. Equipment and sub-assemblies are to be installed, started, and tested as components of each respective system rather than as a category of equipment or by specification section.

E. The systems to be commissioned shall include but are not limited to the following:

1. Air Handling Units
2. Exhaust Fans
3. HTHW Heat Exchangers
4. Pumps
5. Fan Coils
6. Terminal Devices (VAV boxes)
7. Sump Pumps
8. Air Transfer Fans
9. Hot Water Heaters
10. Building Control System - Direct Digital Control System
11. Energy Management System
12. Workshop Airflow Control System
13. Hydronic Systems
14. Heat Exchangers
15. Automated Lighting control systems
16. Emergency generators
17. Transfer switches

18. Environmental Rooms (hot or cold)
19. Utility Meters and sub-metering system
20. VFDs
21. Power to Mechanical Systems
22. Lighting Inverter
23. Irrigation Systems
24. Window Switches related to natural ventilation control
25. Solar Photovoltaic Power Systems
26. Solar Domestic Hot Water Systems
27. Water Reuse Systems
28. VRF Systems
29. Radiant Heaters
30. Heat Recovery boxes
31. Stair Pressurization Fans
32. Irrigation systems
33. Anaerobic Digester
34. Renewable Energy Systems
35. Fire alarm / Fire Detection System.
36. Data Systems.
37. Audio/Visual Systems.
38. Intercom / Telecom Systems.
39. Miscellaneous Low Voltage Systems.
40. Pneumatic Tube System.
41. Building Envelope.
42. Other Systems as Specified.

1.05 CONSTRUCTION AND ACCEPTANCE PHASE COMMISSIONING

A. The **Contractor** will be an active participant in the construction and acceptance phase commissioning activities. The commissioning tasks and responsibilities include following:

1. Respond to requests from the CxA for interpretation/clarification of equipment selection and sequence of operation during functional performance test development.

2. Review, and provide direction as necessary on, the functional performance tests developed by the CxA for conformance with the design intent, within an agreed time interval.

3. Supporting the commissioning process by diligently executing the contract requirements to provide a fully functional facility ready for testing and working closely with the commissioning team to integrate the commissioning process into the project delivery schedule.

4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

5. Cooperate with the CxA for resolution of issues recorded during the commissioning process.

6. Schedule and attend commissioning kick-off meeting and commissioning coordination meetings.

7. Integrate and coordinate commissioning process activities with construction schedule.

8. Develop quality assurance process to verify and document proper installation, access, startup, adjusting, check out and maintenance of commissioned systems.

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

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

10. Review and accept commissioning functional performance test procedures provided by the CxA.

11. Ensure cooperation and participation of specialty subcontractors.

12. Provide to CxA a completed Functional Verification Checklist certifying that for all (listed) systems and equipment to be commissioned, that all systems, subsystems, equipment, and controls are ready for testing.

13. Ensure participation of major equipment manufacturers in appropriate training and testing activities.

14. Execution of the Functional Performance Test protocols for CxA to witness.

15. Manage every aspect of the training program including being responsible for all training requirements. An outline of the training requirements shall be developed with the University and CxA.

16. Responsible for developing and implementing a formal equipment maintenance program to ensure that all equipment specified to be installed on the project is received and maintained in good working order until accepted by the University.

1.06 SUBMITTALS

A. The **Contractor** shall provide the CxA a list of required equipment/system submittals to the CxA. The CxA will identify submittals to be submitted to the CxA concurrent with submission to the University's Representative for review.

B. The **Contractor** shall provide the CxA the requested submittals for the CxA concurrent review, with submission to the University for review.

C. One set of searchable and bookmarked electronic file of coordination drawings which includes all commissioned systems e.g., mechanical, electrical, fire protection, plumbing, and telecom.

D. Names of **Contractor** and subcontractor's personnel who will be responsible for the start-up and commissioning of the facility. To include names, email, and telephone contact information.

E. Start-up and commissioning schedule. To include detailed plan of the sequence of construction with start and completion dates for each phase.

F. Start-up forms for equipment and systems installed in the building. Documents to be used by sub-contractors to ensure that the building complies with the requirements of the contract documents.

G. All Subs, through the **Contractor**, shall submit required installation, start-up, and preventive maintenance equipment data sheets to the CxA within 45 calendar days of equipment acceptance by the University.

H. All Subs, through the **Contractor**, shall submit initial O&M data for system and equipment being commissioned under this specification. Initial O&M data shall be submitted within 45 calendar days of equipment acceptance by the University, but no less than 8 weeks prior to the beginning of functional testing.

I. The **Contractor** shall submit an electronic copy of the construction meeting minutes, updated construction schedule, RFI log, and Bulletin log to the CxA within seven (7) calendar days of each meeting or update.

J. **Contractor** shall submit an electronic copy of training plan and training materials to the CxA for review and approval prior to providing training.

K. Consolidated close out list with all training, Final O&M manuals, As-Built documentation and surplus stock listed by spec section. Information to be compiled from the specifications.

PART II - PRODUCTS

2.01 TEST EQUIPMENT

A. The **Contractor** shall supply all personnel and equipment for the demonstration and testing, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. **Contractor** supplied personnel must be competent with and knowledgeable of all project-specific systems, and automation hardware and software. All training documentation, O&Ms, and submittals shall be at the job site before functional testing commences.

B. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the division **Contractor** for the equipment being tested. For example, the mechanical **Contractor** of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and control systems in Division 23.

C. Special equipment, tools and instruments (only available from vendor/Subs, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be provided by the **Contractor** and left on site, for the CxA to use during functional testing, seasonal testing, and deferred testing. The equipment, tools, and instruments will be returned to the vendor/Subs after successful conclusion of the commissioning effort.

D. The controls **Contractor** shall provide the CxA with temporary software license to be loaded on the CxA's computer, and any necessary network connection cables, for accessing the direct digital control system field panels for system testing. The controls **Contractor** shall also provide a palm device (if applicable) with attachments, software, and cables, to check setpoint values of terminal device controllers. The controls **Contractor** shall provide the CxA with log on ID, password, and LAN IP connection criteria for remote connection to direct digital control system. All the software, cables, and modems provided to the CxA will be returned at the successful conclusion of the commissioning effort.

E. All testing equipment used by the contractors shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Document Specifications (Project Manual). If not otherwise noted, the following minimum requirements apply to test and measurement equipment: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.1°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART III - EXECUTION

3.01 AFTER AWARD OF CONTRACT

A. The **Contractor** shall identify the person on their staff who will serve as the Commissioning Coordinator (CC). This person shall be responsible for all startup and commissioning issues on the project. Specific duties are identified in Part 1 of this Section.

B. Within the first 30 calendar days of the project the **Contractor** shall meet with the University and the commissioning agent to discuss the process to be used on the project for managing communication to and from the Cx agent. This is to include the means for communication issues, commissioning reviews, processing submittals, RFIs, change orders, etc., meeting minutes, schedule information, Cx agent observations, and the action item lists. If a mutually agreeable process cannot be agreed upon, the Cx agent's process and software tools will be utilized.

C. Within the first 60 days of the project there will be a meeting of the GC, the Cx agent and the key subcontractor's personnel to review how the Cx process will be implemented on the project and how the communication and documentation requirements will be met. The subcontractors are expected to send the staff that will be participating in the start-up and commissioning meetings.

D. The **Contractor** will submit a schedule listing the key startup and Cx activities. The initial schedule can be general in nature. As the project progresses, the details on the schedule must be sufficient to list the activities of each **Contractor** for each phase of the project and what work must be accomplished before each listed task.

E. The **Contractor** is to identify the team members from each subcontractor who will be participating in the start-up and commissioning meetings. This list is to include the name and contact information for the subcontractor's commissioning coordinator.

F. The **Contractor** is to compile a listing of all factory tests that will take place prior to the start of the start-up and commissioning meetings. The consolidated list, along with an approximation of when they are expected to take place, shall be forwarded to the Cx agent.

3.02 Cx MEETINGS

A. Eight weeks prior to supplying potable water to the building or the permanent power, the Commissioning Coordinator (CC) will schedule the first start-up and commissioning meeting. The meetings will not be concurrent with the **Contractor'**s MEP coordination meeting and are to be scheduled at a mutually agreeable time between the **Contractor**, the Cx agent, and the University.

B. The meetings will initially be held every second or third week as appropriate, and then increase in frequency to weekly as the bulk of the start-up and commissioning work is taking place.

C. During each meeting an updated start-up and commissioning schedule will be distributed. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.

D. During the meetings a consolidated training, O&M, and attic stock list drawn from the contract document requirements will be distributed. Decisions on the O&M review, when the training will take place, and how the stock will be turned over the University will be made based on this document. In addition to the hard copies distributed at the meeting, an electronic version shall be forwarded to the Cx agent and the University.

E. Minutes of the start-up and commissioning meetings will be generated and distributed by the Commissioning Coordinator (CC). The minutes are to incorporate findings from the Cx agent. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.

F. The updated FPTs will be provided to the **Contractor** by the Cx agent.

G. The **Contractor** and the subcontractors will be required to coordinate their activities, and work collaboratively, with the test and balance **Contractor** hired by the University.

H. The **Contractor** will coordinate the schedules for two review meetings to be led by the Cx agent. The first will be a comprehensive test and balance review and needs to include the mechanical subcontractor's wet and dry side foreman. The second meeting will be a controls review. This meeting is to be attended by the controls subcontractor's lead on the project and the programmer. Each meeting is to last at least two hours.

3.03 FIELD START-UP AND TESTING

A. The dates for all field start-up activities shall be listed on the start-up and commissioning schedule.

B. The CxA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional checklists to be completed, during the startup process.

C. The TAB **Contractor** submits their TAB plan, along with the TAB Plan Review Checklist, for approval by the CxA prior to starting TAB work.

D. In general, the checkout and performance verification proceed 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 backchecking FPTs with unacceptable results is not included in the Commissioning Authority’s scope of work. Back-charging applies to additional back-checking required due to lack of preparation by **Contractor**.

10. The CC is responsible for scheduling and coordinating functional testing activities. The **Contractor** shall demonstrate the FPTs after they have verified that performing the FPTs will yield the documented acceptable results. The **Contractor** is subject to back-charging, as specified herein, if acceptable results are not demonstrated because of work that should have been verified during pre-demonstration testing prior to the submittal of the System Readiness Manual. Acceptable results must be obtained during a single demonstration. No more than two delays of less than 15 minutes each are acceptable for each test.

    a. In addition to conducting the functional tests developed by the CxA, the **Contractor** shall be required to complete all start-up and testing procedures as specified elsewhere in the Contract Documents.

    b. Where the CxA requires BMS trending, the CxA will provide a points list within the FPT form that may include both hardware (input/output) and software (virtual) points and appropriate trending intervals.

11. The **Contractor** shall provide trend data to the CxA in electronic format. As a university approved alternative, the **Contractor** can provide the CxA remote access to the BMS and provide training that will allow the CxA to directly download trend data.

12. The CxA will analyze and review the trend data and associated system performance.

3.05 Cx AGENT Functional Performance Testing (FPT)

A. Upon receipt of the Ready to Cx statement, the Cx Agent will coordinate a time with the **Contractor** to witness the FPTs.

B. The CxA develops specific equipment and system functional performance test procedures. The **Contractor** and manufacturer review the procedures to make sure the tests are safe for the equipment provided.

C. The functional test procedures are executed by the **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.

1. The **Contractor** is responsible for scheduling and coordinating commissioning activities. The **Contractor** shall reimburse the University for the cost of commissioning activities that must be repeated because of a lack of preparation or coordination by the **Contractor**. Reimbursable costs include CxA fees for services billed at the CxA's standard hourly rate. Activities subject to back-charging include Repeated back-checking: Commissioning issues are documented in the Commissioning Issues Log. The **Contractor** shall submit a brief written statement describing when and how each issue has been resolved, which shall be added to the Issues Log maintained by the CxA. The CxA will back-check these issues on a one-time-per-issue basis to verify they have been resolved. If the back-checked issues that have not been resolved as reported, the associated cost of the unsuccessful back-check shall be subject to back-charging.

2. Repeated installation verification: Once the **Contractor** has submitted the completed System Readiness Manual forms, the CxA will perform final installation verifications on selected systems. Discrepancies discovered will be reported in the Commissioning Issues Log. Back-checking the correction of these discrepancies shall be subject to back-charging.

3. Repeated witnessing of FPT demonstrations: As specified in this section, the **Contractor** demonstrates the functional performance tests after they have verified that performing the FPTs will yield the documented acceptable results. The cost of witnessing demonstrations that do not demonstrate specified acceptance criteria shall be subject to back-charging.

3.06 SAMPLING

A. As noted in the specifications, multiple identical pieces of non-life-safety or otherwise non-critical equipment will be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.

B. Sampling strategy referenced in the Specifications as the "xx% Sampling—yy% Failure Rule" is defined by the following example:

1. xx = the percent of the group of identical equipment to be included in each sample.

2. yy = the percent of the sample that if failing, will require another sample to be tested.

C. The example below describes a 20% Sampling—10% Failure Rule.

1. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample." If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).

2. If 10% of the units in the second sample fail, test all remaining units in the whole group. If at any point, frequent failures are occurring, and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

3.07 FAILURE DUE TO MANUFACTURER DEFECT:

A. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the **Contractor,** the University, the A/E, or the CxA. In such case, the **Contractor** shall provide the University with the following:

1. Within one week of notification **Contractor** or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the University within two weeks of the original notice.

2. Within two weeks of the original notification, the **Contractor** or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation. The University will determine whether a replacement of all identical units or a repair is acceptable.

3. Two examples of the proposed solution will be installed by the **Contractor** and the PM will be allowed to test the installations for up to one week, upon which the University will decide whether to accept the solution. Upon acceptance, the **Contractor** and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

3.08 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the University, A/E, and CxA. These tests will be conducted in the same manner as the seasonal tests as soon as possible.

B. Seasonal Testing: During the warranty period, seasonal testing shall be completed as part of this contract. Seasonal testing is intended to test the performance of systems under full load conditions that cannot be simulated during the functional testing period. For example, it is impossible to test the heating system under full load conditions in July, so the heating system would be full load tested during the winter months. The CxA shall coordinate this activity. Tests will be executed, documented, and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and As-Builts due to the testing will be made by the **Contractor.**

3.09 TRAINING OF UNIVERSITY PERSONNEL

A. The **Contractor** shall be responsible for training coordination and scheduling and ultimately for ensuring that training is complete. The CxA will be responsible for overseeing and approving the adequacy of the training of university personnel for commissioned equipment.

1. Instructor capabilities shall be commensurate with level of instruction required. Instructor qualifications shall be submitted to University and CxA for review prior to training.

2. The specific training requirements of university personnel by Subs and vendors as directed within the specifications.

3. Each Sub and vendor responsible for training shall submit a written training plan to the CxA for review and approval prior to training. The plan shall include the following elements:

   a. Equipment (included in training)

   b. Intended audience.

   c. Location of training

   d. Objectives

   e. Subjects covered (description, duration of discussion, special methods, etc.)

   f. Duration of training on each subject

   g. Instructor name and qualifications for each subject

   h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

4. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA recommends approval of the training to the University.

3.10 COMMISSIONING ISSUES LOG:

A. Issues identified during the commissioning process, including during site observations, pre-functional testing verification and functional testing, will be logged in the commissioning issues log. The CxA will maintain the master log. For each issue, the CxA will make a recommendation regarding who they believe is in the best position to provide the resolution. However, it is the **Contractor's** responsibility to manage issue resolution, including the determination of how the issue will be resolved and who will do the work.

B. Each issue on the list will be classified with a "status" of either "resolved", "unresolved", or "resolved-unverified". "Resolved" issues are closed, having either been addressed by the **Contractor** and verified as corrected by the CxA or having been accepted by the University. "Resolved-unverified" issues have been reported as resolved by the **Contractor** but are not yet verified by the CxA as resolved. "Unresolved" issues have not been reported as addressed by the **Contractor**. Updated unresolved issues lists will be distributed to team in MS Word/Excel format.

C. Material and method issues discovered during commissioning, but that pertain to **Contractor** construction shall be promptly reported to the A/E, CxA and the University's Representative.

D. When a commissioning issue is resolved, the **Contractor** shall submit an updated list with a written response describing when and how the issue is resolved. The CxA or an applicable member of the Design Team shall then back-check the resolution of said issue. The CxA scope of work includes one back-check of issues that the **Contractor** reports as resolved. Back-charging applies to back-checking required due to lack of preparation of **Contractor**.

3.11 OPERATION AND MAINTENANCE MANUALS:

A. The specific content and format requirements for the standard O&M manuals are detailed in Section 017800 Closeout Submittals. Special requirements for TAB **Contractor** in appropriate Division 23 Sections and for the Controls **Contractor** are found in appropriate Division 23 Sections. Electrical requirements are located in the appropriate Division 26 Sections. Refer to the specifications for additional O&M requirements.

1. System Narrative. The **Contractor**. Shall include in the beginning of the O&M manuals a separate section describing the systems including:

a. A system narrative describing the type and function of the system.

b. Site information, including facility description and current requirements.

c. Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include chilled water distribution system, water system, condenser water system, heating system, supply air systems, and exhaust systems and others as designated. These shall show major pieces of equipment such as pumps, heat exchangers, humidifiers, control valves, expansion tanks, coils, service valves, etc.

B. CxA Review and Approval. Prior to material completion, the CxA shall review the O&M manuals, documentation and redline As-Builts for systems that were commissioned and list other systems documentation that the CxA should review to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the University or A/E, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the University or A/E. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

3.12 CLOSE-OUT PROCESS

A. All start-up documentation generated by the subcontractors shall be submitted to the Cx agent and the University in an electronic format.

B. The sign-in sheets for all training sessions shall be submitted to the Cx agent and the University in electronic format.

C. All training activities will be scheduled at mutually agreeable times between the **Contractor**, the University, and the Cx agent.

END OF SECTION 01 91 00

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SECTION 02 07 00

SELECTIVE DEMOLITION

PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work under this Section shall include:

1. Provide selective demolition as indicated on the drawings and as required by new construction.

2. Asbestos and hazardous materials demolition or removal work is not part of this contract.

1.02 SUBMITTALS

A. Submit for approval selective demolition schedule, including schedule and methods for capping and continuing utility service.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced workmen.

1.04 PROJECT CONDITIONS

A. Coordinate all demolition work with Owner, with special attention to noise, dust, debris removal, or other disturbances.

B. Schedule utility shutdowns at least 48 hours in advance. Maintain fire protection services during demolition operations.

C. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose off site.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 DEMOLITION

A. Do not damage building elements and improvements indicated to remain.

B. All items not listed for “salvage and return to Owner” remain property of Owner, and shall be collected for reuse or recycling as directed by the Owner’s Representative. **Contractor** shall not remove any items of salvage or recycle value from the project site without the express permission of the Owner’s Representative.

C. Do not close or obstruct streets, walkways, driveways or other occupied or used spaces or facilities without the written permission of the Owner and authorities having jurisdiction. Do

not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

D. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

3.02 SCHEDULE

A. Items to remain in place and protected for reuse: See section 01390 – Green Building Policy Implementation.

B. Items to be salvaged for reinstallation in this project:

C. Utilities requiring interruption, capping, or removal.

END OF SECTION 00 20 70

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART I - GENERAL

1.01 DESCRIPTION

A. Scope: The Work of this Section includes all material and installation of cast-in-place Concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes as shown and detailed on the Drawings and specified herein.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.03 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

2. Concrete strength shall be based on ACI 318, Chapter 5.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates

2. Form materials and form-release agents

3. Steel reinforcement and reinforcement accessories

4. Fiber reinforcement

5. Admixtures

6. Waterstops

7. Curing materials

8. Floor and slab treatments

9. Bonding agents

10. Adhesives

11. Vapor retarders

12. Epoxy joint filler

13. Joint-filler strips

14. Repair materials

1.04 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 01, "Specification for Structural Concrete."

2. ACI 17, "Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 302-2R-06, “Guide to Concrete Slabs that Receive Moisture Sensitive Flooring Materials.

G. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

1. Contractor's superintendent.

2. Independent testing agency responsible for concrete design mixes.

3. Ready-mix concrete producer.

4. Concrete subcontractor.

H. Batch plant inspection per CBC 1705A.3.3.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.

2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

PART II - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities

not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾” x ¾”, minimum.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1” to the plane of the exposed concrete surface.

2. Furnish ties that, when removed, will leave holes not larger than 1” in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 755M.

E. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.04 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Moderate weathering region, but not less than 3M.

2. Nominal Maximum Aggregate Size: 1-½" inches.

C. Water: Potable and complying with ASTM C 94.

D. Fly Ash: CBC 1903A.5, Class F

2.05 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride. Use no mixtures not included in the mix design.

2.06 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat, dumbbell with center bulb.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat, dumbbell with center bulb.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

2.07 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 15 mils (0.25 mm) thick:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 15 mils (0.25 mm) thick.

2. Three-ply, nylon or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 15 mils (0.18 mm) thick.

B. Fine-Graded Granular Material: Clean mixture of crushed stone or crushed gravel; ASTM D 448, Size 10, with 100% passing a No. 4 sieve and 10 to 30% passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100% passing a 1-½" sieve and 0 to 5% passing a No. 8 sieve.

2.08 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50% aluminum oxide and not less than 25% ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

C. Penetrating Liquid Floor Treatment – Exterior: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

2.09 CURING MATERIALS – EXTERIOR CONCRETE

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

D. Curing compound and areas to receive compound must be approved by University's Representative prior to placement.

E. Curing Compounds containing Silicates are acceptable for bare or exterior concrete but not in areas to receive any type of flooring materials.

2.10 CURING MATERIALS – INTERIOR CONCRETE

A. No curing compound containing Silicates will be allowed on any interior project.

B. Known curing compounds not containing silicates are;

a. Type I Class B. Wr Meadows Vocom 25

i. Contains 25% acrylic

ii. Must Comply with ASTM – F1315

C. Curing compound shall be compatible with floor finishes.

2.11 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Joint Filler: Two-component, semirigid, 100% solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch-thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch-thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from ⅛” and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, ⅛ to ¼” or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix Compressive Strength (28 Days): 3000 psi.

1. Maximum Slump: 5” (125 mm).

D. Slab-on-Grade: Proportion normal-weight concrete mix Compressive Strength (28 Days): 3500 psi (20.7 MPa).

1. Maximum Slump: 4” (125 mm).

E. Suspended Slabs: Proportion normal-weight concrete mix Compressive Strength (28 Days): 3000 psi (20.7 MPa).

1. Maximum Slump: 4” (125 mm).

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90ºF, reduce mixing and delivery time from 1-½ hours to 75 minutes; when air temperature is above 90ºF, reduce mixing and delivery time to 60 minutes.

PART III - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, ⅛”.

2. Class B, ¼”.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

F. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.

2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50ºF (10ºC) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by University's Representative.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR RETARDERS

A. Fine-Graded Granular Material: Provide sand under vapor retarder, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus ¾” (19 mm).

B. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

C. Pour Concrete directly on Vapor Barrier.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop-or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by University's Representative.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-½" into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Discontinue reinforcing steel at contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of ⅛". Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut ⅛"-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than ½" or more than 1" below finished concrete surface where joint sealants are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.09 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by University's Representative.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24” and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6” into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40ºF, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50ºF and not more than 80ºF at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90ºF at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding ⅛” in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated on drawings and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system

2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 45; and levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and levelness, F(L) 24.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a medium broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with University's Representative before application.

G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.

2. After broadcasting and tamping, apply float finish.

3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTION AND CURING – EXTERIOR

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.

   b. Continuous water-fog spray.

   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12” lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12” and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 CONCRETE PROTECTION AND CURING – INTERIOR

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.

    b. Continuous water-fog spray.

    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12” lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12” and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas within three hours after initial application. Maintain continuity of coating and repair damage during curing period. **Curing Compound cannot have any Silicates**.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period. **Curing and Sealing Compound cannot have any Silicates**.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least two (2) months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid epoxy joint filler full depth in saw-cut joints and at least 2” deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by University's Representative. Remove and replace concrete that cannot be repaired and patched to University's Representative's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½” in any dimension in solid concrete but not less than 1” in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by University's Representative.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

E. Perform structural repairs of concrete, subject to University's Representative's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to University's Representative's approval.

3.17 FIELD QUALITY CONTROL

A. University's Testing Agency: University will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Samples for strength test of each class of concrete placed each day; or not less than once for each 50 cubic yards of concrete; or not less than once for each 2,000 square feet of surface area for slabs or walls. Additional samples for seven day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

   a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

5. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

   a. Test two field-cured specimens at 7 days and two at 28 days.

b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to University's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by University's Representative but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by University's Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by University's Representative.

END OF SECTION 03 30 00

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SECTION 05 50 00

MISCELLANEOUS METAL FABRICATIONS

PART I - GENERAL

1.01 DESCRIPTION:

A. Scope: Work under this Section shall include all material and installation necessary to provide Miscellaneous Metal Fabrications, as shown and detailed on the drawing and specified herein.

1.02 QUALITY ASSURANCE

A. References:

1. 2022 California Building Code (CBC)

2. American Institute for Steel Construction (AISC): Steel Construction Manual, 15th Edition.

3. American Welding Society (AWS): D1.1 Structural Welding Code

4. National Association of Architectural Metal Manufacturers (NAAMM): Standards

5. Steel Structures Painting Council (SSPC): Painting Manual

B. QUALIFICATIONS:

1. General: Fabricator and installer specializing in the work of this Section with minimum three (3) years documented experience.

2. Welding: Performed by certified welders per AWS

1.03 SUBMITTALS

A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings: Submit manufacture and installation details, including fastenings.

C. Product Data: None required for specified products; required for alternate products.

D. VOC compliance certificate signed by manufacturers certifying compliance of their products with regulations of authorities having jurisdiction over volatile organic compounds (VOCs).

1.04 PRODUCT HANDLING

A. General: Refer to Section 01310 – COORDINATION

B. Items Requiring Anchorage in Concrete: Deliver with complete setting diagrams, measurements, ICC evaluation reports, and manufacturer’s written instructions.

1.05 GUARANTEE

A. General: Refer to Section 01770 – CONTRACT CLOSEOUT.

B. Period: Provide in required form for a period of one (1) year from the date of final acceptance by the University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

A. Steel Shapes:

1. General: ASTM A36 except ASTM A992 for wide-flange shapes

2. Steel Tubing: ASTM A500, Grade B

3. Steel Pipe: ASTM A53, Grade B

B. Fastenings:

1. General: Bolts, nuts, screws, washers, and other various fastenings necessary for proper erection of work. Galvanized steel fastenings or other non-rusting types for exterior steel work.

2. Exposed in Finished Surfaces: Tamperproof countersunk Phillips flat head screws, unless otherwise shown; finish to match adjacent surfaces.

3. Plastic Screw Anchors:

a. Type HUD, manufactured by Hilti, Inc.

b. Star Anchors and Specialty Fasteners, Inc., or equal.

C. Post-installed Anchors:

1. Except where indicated on the drawings, post-installed anchors shall consist of the following anchor types as provided by Hilti, Inc. or approved equal.

a. Anchorage to concrete

A. Medium duty mechanical anchors for cracked/uncracked concrete.

1) Hilti KWIK HUS EZ and KWIK HUS EZ-I screw anchors per ICC ESR-3027
2) ITW Red Head PER ICC-ESR 2427
3) Powers Power-Stud SD2 per ICC-ESR 2502
4) Hilti KB-TZ2 expansion anchors per ICC ESR-4266

b) Rebar doweling into concrete.

A. Adhesive anchors for cracked concrete use

1) Hilti HIT-HY 200 Safe Set System with Hilti Hollow Drill Bit System with continuously deformed rebar per ICC ESR-3187.

2) Hilti HIT-RE 500-SD Epoxy Adhesive Anchoring System with continuously deformed rebar per ICC ESR-2322.
3) ITW Red Head EPCON G5 per ICC-ESR 1137
4) Powers PE 1000 per ICC-ESR 2583

2) Anchor capacity used in design shall be based on the technical data published by the manufacturer or such other method as approved by the Structural Engineer of Record. Substitution requests for alternate products must be approved in writing by the Structural Engineer of Record prior to use. Contractor shall provide calculations demonstrating that the substituted product is capable of achieving the performance values of the specified product. Substitutions will be evaluated by their having an ICC ESR showing compliance with the relevant building code for seismic uses, load resistance, installation category, and availability of comprehensive installation instructions. Adhesive anchor evaluation will also consider creep, in-service temperature and installation temperature.

3) Install anchors per the manufacturer instructions, as included in the anchor packaging.

4) Overhead adhesive anchors must follow manufacturer's printed installation procedures.

5) The contractor shall arrange an anchor manufacturer's representative to provide onsite installation training for all of their anchoring products specified. The Structural Engineer of Record must receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of installing anchors.

6) Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete. Install anchors in accordance with spacing and edge clearances indicated on the drawings.

7) Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors, by Hilti Ferroscan, GPR, X-Ray, chipping or other means.

D. Non-Shrink Grout:

1. "Embco" manufactured by BASF Corporation

2. W.R. Meadows, Inc, or equal.

E. Primer: Per Section 09900 – PAINTING

2.02 FABRICATION

A. Workmanship:

1. General: Shop assemble work in largest practical sections; minimize field connections. Grind smooth parts exposed to view; remove weld marks and leave free of fabrication marks. Miter corners and edges unless otherwise shown. Make members true to length so assembling may be done without fillers. Bends, twists, open joints in finished members, or projecting edges or corners at connections will

not be permitted. Miter, cope, and block carefully to produce tight hairline joints. Provide lugs, clips, connections, bolts, and fastenings necessary to complete fabrication.

2. Galvanizing: Treat all areas burned off or damaged during fabrication with specified repair compound.

3. Reinforcement: Provide proper reinforcement for hardware, and other fabricated metal work, as required.

4. Welding: Use sequence welding to minimize distortion and heat stresses. Weld by shielded electric arc process per AWS. Use continuous welding along entire area of contact, except where spot welding is permitted. Grind all welds smooth on exposed surfaces. Spot welding not permitted on exposed surfaces.

5. Shop Painting: Per SSPC standards.

B. Fabrications:

1. Fasteners: As shown.

PART III - EXECUTION

3.01 PREPARATION

A. General: Refer to Section 01310 – COORDINATION

B. Conditions of Work in Place: Carefully examine before beginning work; report defects.

C. Job Measurements: Take field measurements; report discrepancies between plan and field dimensions.

3.02 INSTALLATION

A. Performance:

1. General: Install with workmen skilled in the particular type of work required and in accordance with the written instructions of the manufacturers.

2. Coordination: Deliver miscellaneous metal items to be installed in concrete or masonry, complete with all clips, anchors or bolts necessary to secure them in place.

3. Workmanship: Set work plumb and true; properly assemble and erect in a rigid and workmanlike manner. Do cutting, punching, drilling and tapping for attachment of other work coming into contact with fabricated metal work where indicated or as directed. Do necessary cutting, drilling, and fitting for installation of fabricated metal work. Execute drilling, cutting, and fitting carefully; when required, fit work at job before finishing. No burning in field permitted. Replace, or repair parts damaged or injured during erection in an acceptable manner. Drill holes for fasteners to exact diameter as recommended by fastener manufacturer. Oversized holes or holes not properly located that produce misalignment of fastener will be rejected.

4. Field Touch-up: Touch-up damaged surfaces and field welds of steel, scheduled to be painted, per SSPC standards.

5. Protection: After erection, provide proper protection for fabricated metal items from other construction operations.

B. Non-shrink grout:

1. Convene pre-application meeting two (2) weeks before start of application of non-shrink grout.

2. Require attendance of parties directly affecting work of this section, including contractor, architect, engineer, applicator, and manufacturer's representative.

3. Review materials, surface preparation, forming, mixing, placing, curing, protection, and coordination with other work.

END OF SECTION 05 50 00

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SECTION 07 60 00

FLASHING AND SHEET METAL

PART I - GENERAL

1.01 DESCRIPTION:

A. Scope: Work under this Section shall include all materials and installation necessary to provide Flashing and Sheet Metal, as shown and detailed on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. References:

1. National Roofing Contractors Association (NRCA): Roofing Manual.

2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Sheet Metal Manual.

B. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience; manufacturer approved.

1.03 SUBMITTALS

A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings: None required for specified products; required for alternate products.

C. Samples: If specifically requested.

D. Product Data: None required for specified products; required for alternate products.

1.04 PRODUCT HANDLING

A. General: Refer to Section 01310 – COORDINATION.

B. Storage: Stack preformed material to prevent twisting, bending or abrasion; slope to ensure drainage.

1.05 MAINTENANCE

A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES

B. Guarantee: Provide in required form for a period of two (2) years from date of final acceptance by University.

PART II - PRODUCTS

2.01 MATERIALS

A. Sheet Material:

1. Galvanized Sheet Metal: ASTM A446, Grade A, G90 zinc coating; 24 gage minimum, core steel.

2. Aluminum: ASTM B209, 3003 alloy, 18 gage with clear [color] anodized finish.

B. Underlayment: ASTM D226, 15 lb. asphalt saturated roofing felt, unperforated.

C. Fasteners:

1. Nails:

a. General: FS FF-N-105.

b. Steel Nails: Hot-dipped galvanized, annular thread, size as required.

c. Concrete Nails: Flat head, size as required.

d. Aluminum Nails: Annular thread, size as required.

2. Rivets: ⅛" diameter; solid type.

3. Washers: Lead or neoprene, where required.

4. Lead Plugs: Size as required.

D. Solder:

1. General: ASTM B32; 50/50 type.

2. Flux: FS O-F-506.

E. Galvanizing Repair Treatment:

1. Rod: Per ASTM A780.

2. Coating: Per MIL-P-46105.

F. Protective Coatings:

1. General: FS TT-C-494, Type II; bituminous.

2. Backing Paint: Zinc chromate, alkyd.

G. Plastic Cement: FS SS-C-153, Type I; asphaltic.

H. Sealing Tape:

1. No. 606 Architectural Sealant Tape as manufactured by Protective Treatments, Inc.,

2. Or equal, no known equal.

I. Sealants: FS TT-S-230, non-hardening, non-sagging.

2.02 COMPONENTS

A. Reglets:

1. O'Keefe's, Inc.; extruded aluminum with butyl rubber sealer and removable snap-in base flashing,

2. Or equal, no known equal.

3. Cast-in-Place Concrete: Type C.

4. Masonry: Type M.

5. Surface Applied: Type E.

2.03 FABRICATION

A. Manufacture:

1. General: Form sections, per referenced standards, true to shape, accurate in size, square, and free from distortion or defects. Form pieces in single length sheets, not to exceed 10'-0" in length. Hem exposed edges on underside ½"; miter and seam corners.

2. Seams: Flat lock.

3. Corners: One piece with minimum 18" long legs; solder for rigidity, seal with sealant.

4. Cleats: Minimum 2" wide, interlockable with sheet.

5. Vertical Faces: Bottom edge formed outward ¼" and hemmed to form drip.

6. Flashing Toe: Extend toe 2" over roofing; return and brake edges.

7. Soldering: Solder shop formed metal joints. After soldering, remove flux; wipe and wash solder joints clean. Weather seal joints.

8. Back Painting: Paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

B. Assemblies:

1. General: Fabricate with galvanized sheet metal, unless otherwise shown.

2. Flashing:

   a. Exterior Hollow Metal Frame Flashing: 18 gages, as shown.

   b. Gravel Stops: Form corners with interlocking joint, soldered and ground smooth.

3. Roof Drainage:

   a. Overflows and Scuppers: As detailed, with flange and outlet hemmed and joints fully soldered.

PART III - EXECUTION

3.01 PREPARATION

A. General: Refer to Section 01310 – COORDINATION.

B. Examination: Examine conditions of work in place before beginning work; report defects.

C. Measurements: Take field measurements; report variance between plan and field dimensions.

3.02 INSTALLATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Underlayment: Apply one (1) layer of felt underlayment over surfaces as shown; lap all edges 6” minimum, in direction of slope.

C. Application:

1. General: Make corners square, surfaces true and straight in planes, and lines accurate to profiles. Fit sheet metal tight in place; secure using concealed

fasteners. Apply plastic cement compound between metal flashings and felt flashings. Seal metal joints watertight.

2. Expansion and Contraction: Allow for expansion and contraction over an ambient temperature range up to 150ºF; distortions resulting from fastening or expansion and contraction stresses not acceptable

3. Dissimilar Metals: Isolate with heavy coat of bituminous paint. Coat all sheet metal in contact with roofing felts.

D. Components: Install as shown; set flashing to form watertight fit.

E. Assemblies:

1. Flashing:

a. General: Install flashings where shown; miter and solder joints at corners. Lap joints in counterflashing at least 6” and make watertight with sealing tape. Extend counterflashing down not less than 6”.

b. Exterior Hollow Metal Frame Flashing: Provide at frame heads, as shown.

c. Gravel Stops: Set on top of roofing felts in ⅛” thick bed of plastic cement, with laps filled; close ends at scuppers.

2. Overflows and Scuppers: As shown; fit outlet tightly into collar flashing.

F. Sealants: As shown; per manufacturer's directions.

G. Galvanizing Repair Treatment: Repair damaged zinc coating with specified repair compound, as required.

3.03 CLEANING

A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris and thoroughly clean exposed surfaces.

END OF SECTION 00 76 00

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SECTION 07 92 00

CAULKING AND SEALANTS

PART I - GENERAL

1.01 DESCRIPTION:

A. Scope: Work of this Section shall include all materials and installation necessary to provide Caulking and Sealants, as shown and detailed on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. References:

1. Sealant, Waterproofing and Restoration Institute (SWRI): Sealant and Caulking Guide Specification.

B. QUALIFICATIONS:

1. General: The manufacturer of the sealant used shall have been in the business of manufacturing the specified types of such sealants for not less than ten (10) years.

2. Applicator: Installer specializing in the work of this Section with minimum five (5) years documented experience

3. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by Federal and State EPA regulations.

C. Compatibility With Substrate: Verify that caulking and sealants used are compatible with joint materials.

D. Joint Tolerances: Comply with manufacturer's joint width/depth ratio limitations.

1.03 SUBMITTALS

A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Samples: Submit manufacturer's standard colors prior to application.

C. Product Data: Submit manufacturer's specifications, data, and installation instructions for review prior to purchase or application.

D. Certificates: Submit certification that sealants proposed for use, comply with the Contract Documents.

1.04 PRODUCT HANDLING

A. General: Refer to Section 01310 – COORDINATION.

B. Storage: Per manufacturer's recommendations for proper precautions for shelf life, temperature, humidity and similar storage factors to ensure the fitness of the material when installed.

1.05 SITE CONDITIONS

A. Environmental Requirements: Do not apply materials when temperature is below 40°F, nor under extreme temperature conditions when joint openings are at maximum or minimum width.

1.06 MAINTENANCE

A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES.

B. Guarantee: On form provided at end of Section 01780 – CLOSE OUT SUBMITTALS, provide five (5) year written guarantee commencing from date of final acceptance by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

A. Caulking And Sealants:

1. Manufactured by Tremco, Inc., unless otherwise noted.

2. Pecora Chemical Corp. or equal.

3. Color to be selected by University's Representative.

B. Exterior Joints:

1. Vertical Surfaces: Non-sag polyurethane; by Dymeric or equal.

2. Precompressed Expanding Sealant Tape:

a. PC-SA manufactured by Emseal Joint Systems, Ltd.

b. Pecora Chemical Corp. or equal.

3. Horizontal Paving Joints: Self-leveling polyurethane; THC 900; interior and exterior.

C. Interior Joints: Acrylic Latex.

D. Joint Cleaner: Provide cleaner recommended by sealant manufacturer for specific joint surface and condition.

E. Joint Primer and Sealer: As recommended by sealant manufacturer for each condition.

F. Bond Breaker Tape: Pressure sensitive polyethylene tape.

G. Other Materials: Manufacturer's standard for items required or type best suited for intended use.

PART III - EXECUTION

3.01 PREPARATION

A. General: Refer to Section 01310 – COORDINATION.

B. Conditions Of Work In Place:

1. General: Carefully examine before beginning work; report defects.

2. Substrate: Inspect surfaces to insure that no bond-breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired.

C. Preparation Of Surfaces:

1. Surfaces: Prepare joints in accordance with manufacturer's recommended instruction to ensure maximum adhesion. Prime as required, protecting adjacent exposed surfaces.

2. Sealants: Prepare sealant as required, including proper mixing of multicomponent sealants.

3.02 APPLICATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Protection: Protect surfaces adjacent to joints to receive sealant. Cover joints in walking surfaces with heavy duty, non-staining tape, until material has dried.

C. Installation:

1. General: Install sealant materials per manufacturer's instructions. Prevent three-sided adhesion. Provide sealant depth of ½ joint width; minimum depth of ¼"; maximum of ½", unless otherwise required by the manufacturer.

2. Backer Rod: Install using blunt or rounded tools to insure uniform (±⅛") depth without puncturing material. Use oversize backer rod; minimum of 33% for closed cell type; minimum of 50% for open cell type, unless otherwise required by the manufacturer.

3.03 CLEANING

A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions. Perform cleaning in a manner that will not affect the appearance of the sealant or the adjacent finish material.

END OF SECTION 00 79 20

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SECTION 22 00 00

PLUMBING GENERAL CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies the Division 22 Work coordination requirements with general work provisions.

B. For convenience and reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime **Contractor** and his Subcontractors. In any case, the Prime **Contractor** is responsible to the owner for a complete job.

C. This section consists of General Requirements and Standard Specifications covering certain parts of work under Division 22 and is supplemented by other Division 22 sections covering additional work, requirements, and materials specifically applicable to the work of each section.

1. Requirements of subsequent sections of the specifications, if in conflict with these General Requirements, shall govern.

D. No material installed as part of this WORK shall contain asbestos in any form.

1.2 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. This section is a Division-22 Basic Materials and Methods section and is a part of each Division -22 section.

1.3 DESCRIPTION OF REQUIREMENTS

A. Provide finished work, tested and ready for operation including apparatus, appliances, materials, and work. Provide incidental accessories necessary to make the work complete and ready for operation without additional expense to the Owner.

B. Before beginning work or ordering materials, consult Architect for clarification of discrepancies between, or questionable intent, of the Contract Documents.

C. **Contractor** shall visit the site and field survey the existing site conditions prior to bid. Any site conditions which may cause significant deviation from the design drawings shall be brought to the attention of the Owner’s representative for clarification prior to bid.

1.4 REQUIREMENTS OF REGULATORY AGENCIES:

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

1. California Code of Regulations - Title 24 - Parts 2, 3, 4,5, and 9
2. California Code of Regulations - Title 22 - Chapter 7

3. California Building Code
4. California Mechanical Code
5. California Plumbing Code
6. California Electric Code
7. California Fire Code
8. California Building Energy Efficiency Standards
9. California Green Building Standards
10. California Energy Code
11. National Fire Protection Association
12. CAL-OSHA
13. Occupational Safety and Health Administration
14. State Fire Marshal, Title 19 CCR
15. Other applicable state laws
16. Office of Statewide Health, Planning and Development

Code edition for the above shall be as noted on the drawings and as adopted by the California Division of the State Architect.

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes.

C. Conform to State of California Energy Conservation Standards for all systems, equipment, and construction.

D. The above Codes and Standards define minimum requirements required for the project. Where Contract Documents differ from governing codes, furnish and install higher standard.

1.5 FEES, PERMITS, AND UTILITY SERVICES:

A. Arrange for required inspections and permits required in installation of the work.

B. The Owner will pay charges for permits required.

C. Arrange for utility connections and pay charges incurred, including excess service charges, if any.

D. Obtain the first permits to operate any compressed air tanks that are required to be furnished under this work, pay all costs, and perform all tests required to obtain permits. Post permits under glass in a conspicuous place on or near the tanks, as required by these authorities.

1.6 SITE EXAMINATION:

A. Examine site, verify dimensions and locations against Drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations

and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

C. Exercise care in excavating near existing utilities to avoid any damage thereto. This **Contractor** is responsible for any damage caused by his operations.

1.7 ACTION SUBMITTALS / MATERIAL LIST AND SUBSTITUTIONS:

A. Prior to commencement of work, and within 35 days after award of Contract, submit to Architect for review electronic copies of a complete list of equipment and materials to be furnished, including all substitutions. All submittals to be in electronic format as follows:

1. Submittals to be in PDF Format.
2. Individual PDF cut sheets shall be inserted into a single file for review.
3. All sheets to be “unprotected” and “writable”.

B. Provide submittal information for all materials proposed for use as part of this project. Provide standard items on specified equipment at no extra cost to the contract regardless of disposition of submittal data. Other material or methods shall not be used unless approved in writing by the Architect. The Architect’s review will be required even though “or equal” or synonymous terms are used.

C. It is the responsibility of the **Contractor** to assume all costs incurred because of additional work and/or changes required to incorporate the proposed substitute into the project including possible extra compensation due to the Architect. Refer to Division 1 for complete instructions.

D. **Contractor** to provide complete Submittal packages for all plumbing items clearly separated by system. At a maximum, submittals to be broken into the following packages:

1. Plumbing – Common Work, Valves & Accessories, Insulation, and Piping.
    a. When required by schedule, a separate Plumbing Underground submittal package will be reviewed upon request.
2. Plumbing – Equipment
3. Plumbing Seismic Shop Drawings
    a. Seismic Shop drawings to show bracing requirements and locations as required by Mason OPM-0043-13.
    b. Seismic shop drawings are submitted whether bracing is required or not. Where bracing is not required, drawings shall be submitted with a statement stating that systems have been reviewed and, no seismic supports are required.
4. Incomplete submittals or submittals broken down by spec section shall be returned un-reviewed.

E. Identify each item by manufacturer, brand, trade name, model number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment.

1. Where submittal sheets indicate more than one product, **Contractor** to clearly identify product being submitted. **Contractor** to cross-out information not being submitted for review.
2. Submittals that do not clearly identify submitted item will be returned to the **Contractor** un-reviewed.

F. Identity each submitted item by reference to specification section number and paragraph in which item is specified. Cross reference submittals by equipment ID where applicable.

G. Quantities are the **Contractor**'s responsibility and will not be reviewed.

H. If **Contractor** desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified.

1. Only one request for substitution will be considered on each item of material or equipment. No substitutions will be considered thereafter.

2. Scheduled Products and first named manufacturer/product forms basis of design. All other manufacturers' products are substitutions.

3. No substitutions will be allowed unless requested and reviewed in writing.

4. The Architect shall review and take appropriate action on shop Drawings, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the **Contractor**.

5. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the **Contractor**, nor shall the Architect be required to review partial submissions or those for which submissions for correlated items have not been received. Architect reserves right to require originally specified item.

6. Named non-basis-of-design manufacturer does not guarantee approval of equipment submittals. Manufacturers must comply with all the performance and features as specified within the specifications and as indicated on the design documents.

I. Installation of reviewed substitution is **Contractor**'s responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the owner. Review by the Architect of the substituted equipment and/or dimensional Drawings do not waive these requirements.

1.8 CLOSEOUT SUBMITTALS / MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Instruct the Owners' authorized representatives in the operation, adjustment, and maintenance of all mechanical equipment and systems. Provide 3 copies of certificate signed by Owner's representatives attesting to their having been instructed.

B. Furnish Architect with three complete sets of operating and maintenance (O&M) instructions.

1. O&M manuals to be bound in hardboard binder and indexed.

2. O&M manuals to include: descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every mechanical system and piece of equipment furnished under these specifications.

3. Include in each set a copy of the air balance test report specified hereinafter.

C. **Contractor** must start compiling the above data (including obtaining operating and maintenance instruction data and catalog cuts and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation will not be made until booklets are submitted and have been reviewed by the Architect.

E. O&M manuals to incorporate the following:

1. Complete operating instructions for each item of plumbing equipment.
2. Test data and system balancing reports as specified.
3. Manufacturer's bulletins with parts numbers, instructions, etc. for each item of equipment. Remove information not applicable to project.
4. Typewritten maintenance instructions for each item of equipment listing in detail the lubricants to be used, frequency of lubrications, inspections required, adjustment, etc.
5. A complete list and/or schedule of all major valves giving the valve ID, location of valve, and the rooms or area controlled by the valve.
6. Provide copies of start-up reports for each piece of equipment provided as part of this work.
7. Name, address, and phone number of contractors involved in work under this Division.
8. Detailed step-by-step instructions for starting, summer operation, winter operation, and shutdown of each system.
9. Detailed maintenance instructions for starting, summer operation, winter operation, and shutdown of each system.
10. Spare parts list.
11. Full size Record as built shop drawings in hard copies and in AutoCAD 2018 (or newer addition) CAD files.
    a. **Contractor** to incorporate field mark-ups into record drawings. Mark-up shop drawings not acceptable.

1.9 COORDINATION SHOP DRAWINGS

A. General:

1. Prepare and submit for review coordination drawings where work by separate entities requires fabrication of products and materials which must accurately interface or for which space provided is limited.
2. Coordination drawings shall indicate how the work will interface and installation will be sequenced. It is the intent of this provision to find, bring forth, and resolve potential constructability problems prior to actual construction, thereby allowing for the resolution of issues before construction cost and schedule are impacted.
3. Submittal of copies of the Plumbing Contract Documents shall not take place of Coordinated Shop drawings.

B. The General **Contractor** shall oversee preparation of coordination drawings, assign priority space, and bring to the attention of the Architect any conflicts or interferences of an unresolved nature found during preparation of coordination drawings. Expedite conflict or interferences and submit solutions/ recommendations for approval review.

C. Drawings: Shop drawings shall include but are not necessarily limited to the following:

1. Submit 1/4" = 1'-0" minimum scale, a combined, comprehensive mechanical coordination drawing. Coordination drawing shall include all plumbing piping overlaid and coordinated with all HVAC ductwork, mechanical piping, sprinkler systems, and ceiling systems

overlaid on structural frame and architectural plan. Shop drawings are to be coordinated with all electrical and Telecom systems.

2. Criteria: Plumbing Piping, Ductwork, mechanical piping, and sprinkler system components shall be sized as shown on Drawings. Seismic restraints shall be shown where required.

   a. Nonconforming Mechanical work installed within designated coordination areas is subject to removal and replacement by the installing **Contractor** at no additional cost to Owner.

3. Provide sections for congested areas.

4. Identify typical areas, start preparation of coordination drawings for such areas first.

D. Coordination drawings shall be signed and dated by individual trade contractors. By act of signature and submittal of singular combined coordination drawing, each trade **Contractor** acknowledges their coordinated portion of the work with all other mechanical, electrical, telecom, architectural, and structural work contractors.

E. After completion of coordination shop drawings signed by individual trade contractors. Submit copies to the architect for review. Once approved, provide copy at the job site for reference. No work shall be performed without the complete coordination shop drawings.

F. No request for information regarding the routing of pipes and placement of equipment will be reviewed and responded to without a completed shop drawings.

1.10 SITE CONDITIONS

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

1.11 WARRANTY

A. Be responsible for work done and material installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show damage to itself or other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

C. Provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

D. Warranties shall be for a period of 2 years from the date of substantial completion unless more stringently specified within individual Sections of this Division.

PART 2 PRODUCTS

2.1 GENERAL:

A. Mention herein or on Drawings requires that this **Contractor** provide each item listed of quality noted or equal. Refer to subsequence division 22 specification sections for specific equipment and system materials and accessories.

B. All material shall be new, full weight, standard in all respects, and in first- class condition.

C. Provide materials of the same brand or manufacture throughout for each class of material or equipment wherever possible.

D. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.

E. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect.

F. Conform to the State Energy Conservation Standards for all material and equipment.

2.2 MATERIALS FURNISHED:

A. Identify all materials and equipment by manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new equipment. Variance from this permitted only with written consent of the Architect.

D. Deliver, Protection, and Care:

1. Deliver materials or equipment to the Project in the manufacturer's original, unopened, labeled containers.
2. Added costs associated with reordering, expediting orders, or project delays due to rejected materials shall be borne by the **Contractor**.
3. Protect from damage which may be caused by theft, weather, and building operations. Failure to protect materials and apparatus adequately shall be sufficient cause for rejection of any damaged material or equipment.
4. Close pipe and equipment openings to prevent intrusion of obstructions and damage.
5. Owner or Architect will require removal and replacement of such material or work from the premises which is not in accordance with Contract Documents. Replace unsatisfactory work without delay, at no additional cost to the Owner.
6. All material and equipment shall be protected against moisture, dirt and damage. Protective coverings shall be provided for bearings, open connections to pumps and tanks, coils, pipes and similar equipment that is vulnerable to grit and dirt.
7. The interior of the pipes shall be kept clean at all times.

PART 3 EXECUTION

3.1 GENERAL:

A. General arrangement and location of piping, equipment, etc. are shown on Drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work. Provide all offsets as required to avoid other trades at no additional cost to the owner.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This shall not be cause for additional cost.

C. Execute any work or apparatus shown on the Drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from Drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this **Contractor** from furnishing same in place complete.

D. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

1. Minor piping associated with instrumentation and control is generally not shown. Interconnection of sensors, transducers, control devices, instrumentation panels, is the responsibility of the **Contractor**. Small piping associated with water cooling, drips, drains and other minor piping may not be shown to avoid confusion in the plan presentation but shall be provided as part of contract work. Drains shall be piped to the nearest floor drains.

E. Furnish materials and work at proper time to avoid delay of the work.

F. Coordinate with testing and balancing **Contractor** to review drawings for proposed additional balancing components required for proper system testing and balancing.

3.2 ACCESS:

A. Continuously check Architectural Drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of **Contractor** to foresee means of installing his equipment into proper position.

3.3 CLOSING IN OF UNINSPECTED WORK:

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.4 PROJECT MODIFICATIONS:

A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this project, such alterations shall be immediately called to the attention of the Architect. **Contractor** shall then prepare necessary Drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.

B. Two sets of Drawings showing all revisions shall be immediately presented to Architect for his records. Maintain additional copies on the project as necessary to comply with "RECORD DRAWINGS" requirement of the General Requirements.

C. Incorporate all revisions into record Drawings.

3.5 FORMING, CUTTING AND PATCHING:

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this **Contractor** fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this **Contractor** is responsible.

C. This **Contractor** is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this **Contractor**. Repair or replace damage to existing work with skilled mechanics for each trade involved in first-class manner.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices will not be allowed.

F. Core openings through existing construction as required for the passage of new piping and conduits. Cut holes of the minimum diameter to suit size of pipe installed and associated insulation.

3.6 DEMOLITION AND SALVAGE:

A. Provide demolition of plumbing work under this SECTION as indicated on Drawings.

B. Removed materials which will not be re-used 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 the premises. Carefully remove materials claimed by the owner to prevent damage. Coordinated delivery of such items to owner.

C. Removed materials which are to be reused are to be removed, cleaned, and stored in a safe location. If such items are lost or damaged by the **Contractor**, item shall be replaced with new item at no added cost to owner. If item is found to be damaged prior to removal, inform Architect prior to removal so that item may be examined by Architect and owner for further instructions.

3.7 WELDING FOR PLUMBING WORK

A. All welding and inspection requirement shall be in accordance with the California Mechanical Code.

B. Qualify welding procedures, welders and operators shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX, welding and brazing qualifications. Welding procedures and testing shall comply with ANSI standard B31.9 - Standard Code for Pressure Piping, and the American Welding Society (AWS) welding handbook.

C. Soldering and brazing procedures shall conform to ANSI B9.1 standard safety code and NFPA 99.

D. All welders shall be certified by a state approved welding bureau. Fabricator shall have current and valid certificated registration by the building official for the types of welds required by the project. Prior to start of the project, the fabricator shall submit a copy of certificate of registration for approval. Prior to project close out, the fabricator shall submit a certificate of compliance that the work was performed in accordance with the approved plans and specifications to the building official and to the Engineer or Architect of record.

3.8 EXISTING SERVICES:

A. Provide and install all required connections to existing systems as required by the Drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 72-hour minimum notice to Owner of service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours at no additional cost to owner.

3.9 STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS:

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-16. Chapters 13, 26, and 30.

B. Provide seismic sway bracing for all suspended piping in accordance with the OSHPD anchorage pre-approval OPM-0043-13 the “Mason West Inc. Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”.

3.10 START-UP PROVISIONS FOR PLUMBING WORK

A. General: Major equipment (such as booster pumps) start-up shall be performed by the equipment manufacturer or authorized representative.

B. Adjusting and Aligning Equipment: Adjust all equipment. Check all motors for proper rotation.

C. Lubrication:

1. Extend grease fittings on bearings to points of ready and easy accessibility.
2. Lubricate fan bearings, etc., before operation of any equipment.
3. Provide a final lubrication to equipment immediately before turning over to Owner.

D. Provide training and orientation of Owners operating staff in proper care and operation of equipment, systems and controls.

E. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. Final observation will not be made until all of the above have been completed and a preliminary copy of the balance report has been submitted and reviewed.

3.11 PLUMBING RECORD AS-BUILT DRAWINGS:

A. During the course of Project Construction, Mechanical **Contractor** shall maintain recorded "AS-built" information by distinctively marking up approved shop drawings prints to depict all actual work installed on a daily basis form but not limited to field conditions, addendums, architectural supplemental instructions (ASIs), instruction bulletins (IBs), change orders (COs), responses to Request For Information (RFIs), and approved product substitutions.

B. The marked-up shop drawings will be made available at the Construction Site to the Architect upon request, at any time.

C. The marked-up shop drawings with the recorded information shall then be used to create Record As-built drawings at the completion of the project. **Contractor** shall submit the Record As-built drawings in full size hard copies and also in CAD files format using the AutoCAD 2013 or later version.

1. Hand marked shop drawings are not acceptable.
2. Provide 2 complete sets of full-size drawings on 20 pound white bond paper.
3. Provide 1 CD (compact disc) or Thumb Drive with Record drawings in both PDF and AutoCAD, version 2013 or later version.
4. Record as-built drawings are to be full size drawings (same size as Contract Documents) and all plans are to be to standard engineering scale. The minimum drawing scale to match those provided within the Contract Documents.

D. Record As-built drawings shall include the followings:

1. Work on Record As-built drawings shall be provided with horizontal and vertical dimensions. Underground work shall be provided with invert elevations. All dimensions shall be references to permanent building fixed points and/or column lines.
2. Provide sufficient details and sections to depict actual installations.
3. Equipment identifications and system labeling nomenclatures shall match the Project Design Documents.
4. Identification of main shut-off valves shall be based on the approved valve tag list and as actually installed in field.
5. Piping mains and branches, size and location with pipe elevation information and invert elevations for underground piping. All risers shall be clearly identified.
6. Location of plumbing fixtures, including but not limited to clean outs, floor drains, floor sinks, storm drains, catch basins, valve boxes and equipment connections.
7. Locations of all manual and automatic valves, pipe strainers, backflow preventers, water hammer arrestors, expansion joints and compensators, pipe guides and anchor points.
8. Equipment locations with dimensions from prominent building lines and requires service access.
9. Seismic bracing information for plumbing system, piping and equipment
10. Locations and sizes of medical gas control system and alarm panels, zone valve boxes, pressure transducer above ceiling.

3.12 CLEANING UP:

A. Remove tools, scaffolding, surplus materials, barricades, temporary walks, debris, and rubbish from the Project promptly upon completion of the work of each Section. Leave the area of operations completely clean and free of these items.

END OF SECTION 22 00 00

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SECTION 22 05 00

COMMON WORK FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes general mechanical materials and methods required within the project. Items included within this specification section include:

1. Piping Supports
2. Roof Flashing
3. Dielectric Unions
4. Thermometers
5. Gauges
6. Pipe and Equipment Identification
7. Painting
8. Concrete
9. Excavating And Backfill
10. Commissioning and preliminary operational tests

1.2 ACTION SUBMITTALS

A. Product data: submit complete data of materials proposed including:

1. Manufacturer and model number
2. Clearly indicate all options, trim, and accessories.
3. Cross reference manufacturer’s cut sheet to fixture callout ID on submittal sheet.

1.3 CLOEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

C. Operation and Maintenance Data: submit complete O&M data including:

1. Maintenance data and parts lists for each component.
2. Provide "trouble- shooting" maintenance guide
3. Include this data within maintenance manual

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

1.5 WARRANTY

A. Manufacturer: In addition to the **Contractor**'s Standard Guarantee, furnish Owner with manufacturer's warranty for all plumbing valves and accessories against defects in materials and workmanship. Warranty shall cover replacement of product plus labor to install.

PART 2 PRODUCTS

2.1 PIPING SUPPORTS:

A. STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS:

B. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2019 California Building Code, Section 1616A.1.19 and ASCE7-10, Chapters 13, 26, and 30.

C. Mechanical equipment supports shall be designed by a licensed Structural Engineer.

D. Provide seismic sway bracing for all suspended piping in accordance with the Seismic Restraint System Guidelines, OPM-0043-13 by Mason.

E. Acceptable Manufacturer:

1. Mason
2. B-Line
3. Or Equal

F. Vertical Piping:

1. Support vertical piping risers securely with riser clamps, B-Line B3373, or equal. Attach clamps to the pipe above each concrete floor slab, with the arms of the clamp resting on the slab or the structural supports. Provide Superstrut B3373C, or equal clamp when used on copper piping.
2. Support pipe lines passing up through the building at each floor of the building.

G. Horizontal Piping:

1. Use B-Line B3100, or equal, steel strap hanger for uninsulated steel or cast-iron pipe through 8-inch size, and for insulated steel or cast-iron pipe through 4-inch size.
2. Use Superstrut C-710 or equal, steel hanger in pipe sizes where suitable. Use saddle shield as specified for insulated pipes.
3. For uninsulated copper tubing, use B-Line B3100F, or equal, felt lined hanger.

H. Pipe Saddles:

1. Use B-Line B3153, or equal, protective insulation shield with “loc” tabs.

I. Concrete Inserts: Provide B-Line B2500, or equal, concrete inserts.

2.2 ROOF FLASHING:

A. Flashings in metal deck or membrane type roofing:

1. Flashing for penetrations of the roof for mechanical items such as flues and pipes will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the mechanical work.

2. Furnish and install counterflashings above each flashing required in the mechanical work. Flues shall have 24-gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

3. Sewer vents and other piping extending through roof structure shall have flashing provided and installed as part of the roofing work. This **Contractor** shall coordinate his Work accordingly.

B. Flashing in built-up roofing assemblies:

1. Where flashing is not provided and installed as part of other Work, furnish and install a waterproof flashing and counterflashing for pipe and flue passing through roof. The flashing shall extend a minimum of 9 inches in all directions from the outside of the pipe or flue.

2. Sewer vents and other piping extending through roof structure shall have four-pound sheet lead flashings and Semco, Smith, or equal to Semco #1100-4, counterflashing sleeves installed as detailed.

a. Provide Hydroseal at underside of counterflashings as recommended in Semco installation instructions.

3. Flues shall have 24-gauge galvanized steel flashings on all roofs. Securely clamp a storm collar (counterflashing) around the flue above the flashing. Storm collars shall be of same material as flashing.

4. Seal all pipes or flues passing through exterior walls in an approved, watertight manner.

2.3 DIELECTRIC UNIONS:

A. Furnish and install dielectric unions at all locations described herein, whether shown on Drawings or not, and except as noted herein. Construct couplings and flanges so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic plastic threaded in standard pipe sizes. Make up the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

B. Acceptable Manufacturers:

1. Watts Regulator Co.

2. Eclipse, Inc.

3. Perfection Corp.

2.4 THERMOMETERS:

A. General:

1. Thermometers shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not
2. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type.
3. All thermometers shall be round, stainless steel case construction with glass front.
4. Accuracy to be within plus or minus one of the smallest scale divisions throughout the entire range.
5. The thermometer scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.
6. The thermometers shall be located so as to be easily read and shall be furnished with adjustable angle pattern so as to be rotated to any position.
7. Liquid thermometers for tanks and similar equipment shall have a minimum 5-inch diameter face.
8. Thermometers for piping shall have a minimum face diameter of 3 inches.
9. Thermometers installed on insulated tanks or piping shall be provided with an extension neck well to compensate for the thickness of the insulation.
10. Thermometers shall be provided with stainless steel stems and steel wells.
11. Thermometer wells with chain and cap shall be provided where wells are indicated on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:

1. Weston
2. Marsh
3. Taylor
4. Or Equal

2.5 GAUGES:

A. General:

1. Gauges and gauge connections shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not.
2. Accuracy to be within 1 percent in the middle third of the dial range and equipped with front calibration.
3. Dials to be white with black numerals.
4. Normal reading to be mid-scale.
5. Provide a needle valve on each gauge connection.
6. Gauge to have bronze bushed movement and front recalibration.
7. Gauges shall have a minimum dial size of 3-1/2 inches.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:

1. Marsh, Series J
2. U.S. Gage
3. Danton 800

2.6 PIPING AND EQUIPMENT IDENTIFICATION:

A. Pipe Identification:

1. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by a prefabricated coiled plastic colored label.
2. Labels shall comply with ASME A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule shown in this Article.
3. For use indoors use 20 mil vinyl labels, MSI model MS-970, or equal. For piping with an outside diameter greater than 6 inches provide the label manufacturers nylon straps to secure label to piping.
4. For use outdoors use Polyester/Tedlar laminated material, MSI model MS-977, or equal. For piping with OD greater than 6” provide the label manufacturers stainless steel straps to secure label to piping.
5. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors easily discernible.
6. Acceptable Manufacturers:
   a. Marking Services Incorporated (MSI)
   b. Idento Metal Products Co., Idento Bands
   c. Setmark

B. Equipment Identification:

1. Provide white lamacoid plate for each and every piece of equipment installed in this work.
   a. Lettering on plate shall be black, with size of lettering to suit equipment.
   b. Lettering shall be minimum of 3/8-inch in height.
   c. Plates shall be riveted or bolted to equipment.
2. Equipment to include, but not limited to:
   a. Pumps
   b. Water Heaters
   c. Air Compressors
   d. Vacuum Pumps
   e. Etc.

C. Acceptable Manufacturers:

1. Marking Services Incorporated, (MSI)
2. LEM Products
3. Seton

4. Craftmark

2.7 FIREPROOFING

A. Fireproofing to be installed at all pipe, fixture and equipment penetrations of rated assemblies.

B. Fireproofing to be UL Rated fire stop material.

C. Acceptable Manufacturers:
   1. Hilti
   2. 3M Pro-Set
   3. Or Equal

PART 3 EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS:

A. Fasten all piping securely to structure with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.

B. Follow drawing requirements and details where special pipe support requirements are detailed on the Drawings.

C. Do not support piping by perforated tape, wire, rope, wood, nails, or other makeshift devices.

D. Design hangers and supports to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used.

E. Burning or welding on any structural member under load shall not be attempted. Field welding not called for on the Drawings or reviewed shop Drawings may only be done with consent and advice of the Architect and after proper provisions have been made to relieve the stress on the member. The boring of holes in beam flanges or narrow members will not be allowed.

F. Install hanger on insulated piping in a manner which will not produce damage to insulation. Provide steel pipe saddles as required to protect pipe covering. Install pipe hangers on piping covered with insulation on the outside of the insulation and not in contact with the pipe.

G. Fasten hanger rods to concrete structural members with concrete inserts set flush with surface. Install a reinforcing rod through the opening provided in the concrete inserts. Fasten hanger rods to structural members with suitable beam clamps, and provide beam clips to lock clamp securely to beam.

H. Use of powder-actuated fasteners will not be permitted for the support of any overhead piping.

I. Turnbuckles, if used, shall have a load-carrying capacity at least equal to that of the pipe hanger with which they are being used.

J. All threaded parts of pipe hanger assemblies shall have full length of thread in service while in use.

K. Hanger material shall be reviewed by the Architect before installation.

L. Pipe Hanger or Support Spacing:

1. Provide pipe hangers or supports at 6-foot maximum spacing on steel pipe 3/4-inch diameter and smaller and for copper pipe 1-1/2 inches and smaller.
2. Support steel piping 1" and larger and copper larger than 1-1/2 inches at 10-foot maximum spacing.
3. Support steel piping used for gas at the following lengths:
   a. 1/2-inch diameter at 6-feet maximum
   b. 3/4-inch and 1-inch at 8-feet maximum
   c. 1-1/4-inch and larger at 10-feet maximum spacing

M. Provide continuous support channel for all polypropylene piping, and provide 6-foot maximum spacing for hangers, with a minimum of one hanger per length of pipe.

N. Provide hangers or supports for horizontal and vertical cast-iron drainage pipe at every other joint, except that when the developed length between hangers or supports exceeds 4 feet, provide hangers or supports at each joint. Provide adequate sway bracing to prevent shear.

3.2 ROOF FLASHING:

A. Provide pipe flashings as noted on the Drawings.

B. Flue flashings and storm collars shall be securely clamped around flue or storm collar or counterflashing, above flashing.

3.3 DIELECTRIC UNIONS:

A. Install dielectric unions in the following locations:

1. In all metallic water and gas service connections into the building within 5 feet of the building wall. Install adjacent to the shut-off valve or cock and above ground where possible.
2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
3. At points in piping where dissimilar metal pipes are connected together.
4. Any special applications shown on the Drawings.
5. Where steel or cast-iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast- iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.
6. Where copper or brass piping is connected to steel or cast-iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape extending outward a minimum of 5 feet on all pipes, from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of the tape over the piping. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

3.4 THERMOMETERS:

A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb.

B. Enlarge pipes smaller than 2-1/2” for installation of thermometer wells.

C. Apply thermal grease in thermowells prior to installation of thermometers.

D. Where shown on the temperature control diagram, the temperature control subcontractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers.

E. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as specified below.

1. In supply from tank and return of domestic hot water systems near circulating pump, range to be from 30 to 180 ^{o}F.

F. In such cases where the above described thermometers cannot be located so as to be easily read, a remote reading type of thermometer shall be installed, as approved by the Architect.

G. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.5 GAUGES:

A. Gauges shall have indication of 0 to 160 psi where indicated pressure will be greater than 40 PSI and 0 to 60 psi for lesser pressures.

B. Provide gauge connections at the following locations:

1. Inlet and outlet of butterfly-type balancing valves.
2. Suction and discharge of circulating pump.
3. Elsewhere as may be shown on the Drawings.

C. Gauges shall be provided in an convenient location within approximately 5 feet of the flanges or connections and elsewhere as may be shown on the Drawings.

D. A needle-point globe valve, similar to Crane No. 88, shall be supplied at each gauge and gauge connection.

E. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.6 PIPE AND EQUIPMENT IDENTIFICATION:

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. Underground pipe identification shall consist of a buried, continuous, preprinted, bright colored, plastic ribbon cable marker provided for each underground pipe.

C. The legend and flow arrow shall be applied at the following locations:

1. All valve locations,

2. All points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction
3. All exposed locations
4. At approximately 20-foot intervals on pipe runs.

D. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect to meet specific conditions.

E. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

F. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

G. Where different equipment, such as fire sprinklers, are supplied from a common main, such as domestic water, the main should be identified as "Domestic Water" and each respective branch takeoff as "Fire Water," etc.

H. The non-potable water plumbing piping shall be marked with the legend "Danger - Unsafe Water". This legend shall be applied to both hot and cold water systems along the length of the pipe in fluorescent orange at a maximum of five foot intervals.

I. Lettering size and label colors are to be per ASME/ANSI A13.1 Pipe Marking Standards.

3.7 MOTORS:

A. Motors furnished in the Mechanical Work shall be furnished by the Mechanical **Contractor**, but such equipment shall be delivered to the Electrical **Contractor** for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical **Contractor**.

3.8 MOTOR STARTERS SWITCHES, AND WIRING:

A. Starters located in motor control centers will be provided under the Electrical Work. **Contractor** is referred to electrical drawings for motors served by motor control centers.

B. Starters furnished by the Mechanical **Contractor** to be delivered to the Electrical **Contractor** for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical **Contractor**.

3.9 FIREPROOFING:

A. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop.

B. Fireproofing system to be installed in strict accordance with manufacturer’s written instructions and details.

3.10 PAINTING:

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Exposed piping and unfinished portions of equipment to be painted shall be cleaned of grease, oil, rust, or dirt in preparation for painting.

C. Where applicable, remove pipe clamps prior to painting so that entire pipe is painted. Provide temporary support as required. Re-install clamps after priming/painting is complete.

D. Priming:

1. **Contractor** to prime all exposed ferrous metals, including piping, which are not galvanized or factory-finished.

a. Black steel pipe exposed to weather shall be cleaned and primed with one coat of Rust-Oleum, or equal, #1069 primer. Color to be Grey.

E. See Painting Section for detailed requirements.

3.11 CONCRETE

A. Where specifically indicated on the Drawings or specified as part of Mechanical Work, this **Contractor** shall furnish and install concrete work, such as thrust blocks or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for General Construction.

C. Except as noted above, concrete work will be furnished and installed under General Work. This **Contractor** shall coordinate requirements accordingly.

3.12 EXCAVATING AND BACKFILL

A. Perform all excavating required for work of this Section. Do excavating required for installation of piping and service lines and other work that applies as indicated on Drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping. Provide the services of a pipe/cable locating service prior to excavating activates to determine location of existing utilities

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of trench and around pipe as required for caulking, joining, backfilling, and compacting. 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 minimum of 4” deep sand bed to provide a uniform grade and firm support throughout entire length of pipe. For PE gas pipe, bed the pipe in a 4” sand bed.

C. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one-third of pipe. Where rock is encountered, undercut trenches 3 inches and fill with well-tamped, clean sand and pea gravel to correct pipe elevation.

D. After pipe lines in excavation have been installed and tested, backfill excavation to point 6 inches above pipe using sand, fine earth, or other materials free of rocks and large lumps. Proceed evenly on both sides of pipe and continuously tamp. Except as hereinafter noted, backfill above 6 inches above top of pipe shall be made by using earth from excavation placed in layers of 8-inch maximum depth. Compaction of each successive layer will be made with mechanical compactor.

E. Take special care in backfilling over wrapped piping to prevent damage to protective wrapping.

F. Bed sewers under pavements, wrapped piping, and PVC piping in sand prior to backfilling. Backfill to point 6 inches above pipe with sand.

G. This **Contractor** shall replace sod, concrete, asphalt paving, curbs, pavement, walks, and any other type of existing work or surface disturbed by excavation, using workmen skilled in trade involved.

H. When pipe or underground conduit with a protective wrapping is to be placed in the trench, sand only shall be used for bedding the pipe or conduit. The sand used shall be certified to have a minimum resistance of 5,000 ohms per cubic centimeter when wetted to any moisture content with distilled water and shall consist of clean, natural, washed-sand, hard, and durable particles varying from fine particles to particles of such size that all will pass through a 3/8-inch screen, not less than 90 percent will pass through a 1/4-inch screen, and not more than 25 percent will pass through a No. 50 screen.

I. Any backfill placed under this contract which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the **Contractor** by adding compacted backfill or additional paving in paved areas.

3.13 ELECTRICAL WORK:

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electric Code and other applicable codes or ordinances. The mechanical work shall be coordinated with the Electrical Work in order to comply with these requirements. Any work which does not conform to these regulations shall be properly corrected without additional cost to the Owner.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical Work by the Temperature Control Sub-**Contractor**, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and push button or other manual starter switch or branch power circuits required for temperature control systems.

C. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the Temperature Control Subcontractor.

D. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aquastats, and similar items which are to be wired under the Electrical Work or by the Temperature Control Subcontractor, shall be installed by the Mechanical **Contractor**.

E. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at factory before shipment.

F. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Run line and low-voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of Mechanical **Contractor** and shall be of type specified in electrical specifications.

3.14 DEMOLITION

A. Refer to Division 1 sections for general demolition requirements and procedures.

B. Disconnect, dismantle, and remove plumbing 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. 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 to be evacuated per EPA requirements.
3. Equipment to be removed: Drain down and cap remaining services and remove equipment.
4. Equipment to be removed and re-installed: Disconnect and cap services and remove, clean, and store equipment. When appropriate, re-install, reconnect, and make equipment operational.
    a. If existing equipment which is to be re-installed is damage, contact architect prior to removal. **Contractor** to take pictures of any damaged equipment prior to its removal and submit pictures to Architect.
    b. Equipment damaged during removal, storage, or re-installation shall be the **Contractor**'s responsibility and is to be replaced with new at no additional cost to the owner.
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, removed damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Non-Destructive Testing Of Existing Concrete Slabs:
1. When drilling or saw cutting existing reinforced concrete, use care and caution to avoid cutting or damaging the existing reinforcing bars, conduit, or tendons. Use a non-destructive method to locate metals poured into the slab prior to doing any work.

3.15 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

B. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out flush valves, traps, strainers, and pressure-reducing valves.

C. Keep the interior of all piping free of dirt, dust, loose insulation, and other foreign materials at all times.

D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

3.16 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.17 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 22 05 00

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SECTION 22.11.00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. This section includes piping for the facility water distribution system.

1.2 REFERENCES AND STANDARDS

A. Requirements of Regulatory Agencies: Contractor to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, Contractor to provide the more stringent.

1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products.

B. Soldering and Brazing materials and labor shall comply with ASME Code and applicable state labor regulations.

C. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubblers, drinking fountains, piping, etc.

1.3 ACTION SUBMITTALS

A. Submit manufacturer's catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.
2. Indicate all options being submitted.

B. Provide Brazing Certifications. Submit reports as required for piping work applicable to the project.

1. Brazers that do not have current Certifications shall not be permitted to braze on the project.

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

C. Operation and Maintenance Data: submit the following items in O&M data including:

1. Domestic Water System Sterilization Report.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

1.6 WARRANTY

A. Manufacturer: In addition to the Contractor's Standard Guarantee, furnish Owner with manufacturer's warranty for all domestic water piping and accessories against defects in materials and workmanship. Warranty shall cover replacement of piping or accessories plus labor to install.

PART 2 GENERAL

2.1 GENERAL:

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and temperature ratings, and capacities as indicated. Materials and products to comply with the California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.

1. Contractor to provide submittal information on material which is to be installed.
2. Where more than one material is indicated, the Contractor shall only install one material per system and materials shall not be mixed within the same system.

C. Soldering Materials: Joints in copper tubing for all installations shall be made with brazing alloy sil-fos, or equal. Clean surfaces to be jointed shall be free of oil, grease, rust, and oxides.

1. Harris Stay-Safe 50 solder, or equal, may be permitted on plumbing lines above slab or ground only with prior review for piping sizes 2 inches and smaller only. Solders used shall contain no lead.

D. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

2.2 PIPING AND FITTINGS:

A. Industrial Water Piping (cold water, hot water, tempered water, and hot water return):

1. Interior Water Piping:

a. Copper tube, Type L, hard-drawn temper, wrought copper fittings.

b. Pipe sizes 2” and smaller to have solder joints.

c. Pipe sizes 2 ½” and larger to have brazed joints.

B. Pressure and temperature relief valve discharge piping:

1. Provide materials as specified for domestic water piping.

PART 3 EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

D. Locate piping runs, unless detailed otherwise, vertically, and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1” clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

F. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, Contractor to make the necessary deviations to the piping system, as determined by the Contractor, with the Architect's review, without additional cost to Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

3.2 INSTALLATION OF WATER PIPING:

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Water lines shall not be installed in the same trench with non- metallic sewer lines unless the bottom of the water pipe at all points is at least 12 inches above the top of the sewer line and the water line is placed on a solid shelf excavated at one side of the common trench.

C. Where water and waste piping cross, the pipes shall have no fittings within 10 feet of the crossing, and the water line shall be run above the waste line. Comply with any local codes or requirements.

D. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter. Remove and clean all aerators at end of project and prior to sterilization.

3.3 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.

1. Test Hot, Cold, Tempered, and Hot Water Return system with water at 150 PSI after rough-in and at 100 PSI after equipment connection.

B. Testing equipment, materials, and labor shall be furnished by this Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.4 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 12 00

NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes piping as required for the natural gas piping.

1.2 REFERENCES AND STANDARDS

A. Requirements of Regulatory Agencies: **Contractor** to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, **Contractor** to provide the more stringent.

1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products. Fabricate and install natural gas systems in accordance with CPC.
2. ANSI Compliance: Fabricate and install natural gas piping in accordance with ANSI B21.2, *Fuel Gas Piping*.
3. NFPA Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54, *National Fuel Gas Code*.
4. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

B. Welding materials and labor shall comply with ASME Code and applicable state labor regulations.

C. Welders shall be fully qualified and certified by a state approved welding bureau for the types of welds required for the project.

1. Each welder shall identify their work with a marking stamped on each weld joint of pipe, valve, or fitting.

1.3 ACTION SUBMITTALS

A. Submit manufacturer’s catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.
2. Indicate all options being submitted.

B. Provide Welding Certifications. Submit reports as required for piping work applicable to the project.

1. Welders that do not have current Certifications shall not be permitted to weld on the project.

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

1.6 WARRANTY

A. Manufacturer: In addition to the **Contractor**'s Standard Guarantee, furnish Owner with manufacturer's warranty for natural gas piping and accessories against defects in materials and workmanship. Warranty shall cover replacement of all such piping system or accessories plus labor to install.

PART 2 - GENERAL

2.1 GENERAL:

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and temperature ratings, and capacities as indicated. Materials and products to comply with the California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.

1. **Contractor** to provide submittal information on material which is to be installed.

2. Where more than one material is indicated, the **Contractor** shall only install one material per system and materials shall not be mixed within the same system.

C. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above grade only, except where indicated otherwise.

D. Malleable-Iron Threaded Unions: ANSI B16.39; selected by **Contractor** for proper piping fabrication and service requirements, including style, end connections, and metal-to- metal seats (iron, bronze, or brass); plain or galvanized as indicated.

E. Forged-Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

F. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

G. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2 inches and where pipe size is less than 1-1/2 inches, and do not thread nipples full length (no close-nipples).

H. Welding Materials: Except as otherwise indicated, provide welding materials as determined by **Contractor** to comply with installation requirements. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

I. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

J. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast- iron flanges; raised-face for steel flanges, unless otherwise indicated.

2.2 PIPING AND FITTINGS:

A. Natural Gas Piping:

1. Site Piping:

a. Polyethylene Pipe, PE2406; pipe and tubing shall meet requirements of ASTM D2513.

b. Fittings and accessories shall be as manufactured and furnished by the pipe supplier. Fittings shall meet the requirements of ASTM D2513, as mandated by CFR 49 Part 192.59 and is so marked, according to Part 192.63.

2. Piping within building:

a. Black Steel Pipe: ASTM A53, A106, or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.

b. Pipe Size 2 inches and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.

c. Pipe Size 2-1/2 inches and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

3. Piping exposed to weather:

a. Galvanized Steel Pipe: ASTM A53 or A120; except comply with ASTM A53 where close coiling or bending is required.

b. Pipe Size 2 inches and Smaller: Galvanized steel pipe; Schedule 40; malleable-iron threaded fittings.

c. Pipe Size 2 inches and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.

d. Pipe Size 2-1/2 inches and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

e. Clean and paint all non-galvanized steel piping exposed to weather.

1) Provide a minimum of 2 coats of paint.

2) Paint to be continuous – **Contractor** to loosen pipe supports/clamps for painting, then re-install supports/clamps.

B. Liquid Petroleum Gas Piping (LPG):

1. Site Piping:

a. Polyethylene Pipe, PE2406; pipe and tubing shall meet requirements of ASTM D2513.

b. Fittings and accessories shall be as manufactured and furnished by the pipe supplier. Fittings shall meet the requirements of ASTM D2513, as mandated by CFR 49 Part 192.59 and is so marked, according to Part 192.63.

2. Piping within building:

   a. Black Steel Pipe: ASTM A53, A106, or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.

   b. All Pipe sizes: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

      1) Clean and paint all piping exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to **Contractor**.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

D. Locate piping runs, unless detailed otherwise, vertically and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1” clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

F. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, **Contractor** to make the necessary deviations to the piping system, as determined by the **Contractor**, with the Architect's review, without additional cost to Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

H. Installation Of Protective Pipe Wrap:

   1. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material.

I. Installation Of Detectable Underground Warning Tape:

   1. Provide all non-metallic pipes, including but not limited to plastic piping with detectable underground warning tape.

2. Detectable underground warning tape shall consist of 4.5 mil foil tape printed with pipe service, (i.e. “CAUTION GAS LINE BELOW:).
3. Tape shall be buried approximately one-half of the pipes buried depth.
4. Tape buried up to 24” deep shall be a minimum of 3” wide.
5. Tape buried greater than 24” deep shall be a minimum of 6” wide.

3.2 INSTALLATION OF NATURAL GAS PIPING:

A. Run piping generally level, free of unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work

B. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

C. Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.

1. Appliance fuel connectors, as indicated in 1202 of the California Plumbing Code, are not acceptable for connection of equipment, except where specifically indicated on the Contract Documents.

D. Connect gas piping to indoor appliance with flexible appliance flex connector. Each appliance shall be provided with a shut-off valve upstream of the flexible connector.

E. Install Polyethylene Pipe, where defined, in accordance with ASTM D2774 "Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping", and as required by Manufacturer's Installation Instructions.

1. Polyethylene Pipe fittings shall be joined in accordance with pipe manufacturer’s instructions.
2. Connection of plastic pipe with metal pipe shall be only outside underground with ASTM D2513 category I transition fittings.
3. Gas pipe risers to above grade, shall be metallic and shall be wrapped or coated to a point at least six inches above grade.
4. When riser connects underground to plastic pipe, the underground horizontal metallic portion of the riser shall extend at least 30 inches before connecting to the plastic pipe.
5. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gas tight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer.
6. Plastic pipe shall be buried with an electrically continuous corrosion resistant tracer wire (Min. AWG. 14) and tape to facilitate locating. One end shall be brought above ground at a riser.

F. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.

G. Cap or plug openings in pipe and fittings immediately to exclude all dirt until fixtures are installed or final connections made.

H. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.

I. Couplings shall not be used except where required pipe runs between fittings are longer than a standard length of the type of pipe being used and except where their use is specifically reviewed by the Architect.

J. Conceal piping in finished portions of building, above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.

K. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.

L. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.

M. Remove cutting and threading burrs before assembling piping.

N. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped, or damaged.

O. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

P. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection. Provide listed isolation fitting above grade prior to entry into building. Provide independent ground systems for above ground and below grade.

Q. Install drip-legs in gas piping where indicated and where required by code or regulation.

R. Install piping parallel to other piping and walls unless detailed otherwise.

S. Maintain minimum of 12-inch clearance between gas piping and steam piping above 200 ^{O}F.

T. **Contractor** to use extreme care when working with galvanized fittings as to not damage galvanized finish. If finish is damaged, **Contractor** to paint damaged area with “Brite Zinc” paint by “Brite Products” or equal. Follow requirements as outlined in ASTM A780.

3.3 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Cut all steel pipe by power hacksaw, a circular cutting machine using an abrasive wheel or in square end vise by means of hand hacksaw. Wheel cutters may be used for steel pipe provided that pipe shall have ends reamed to full inside diameter and beveled before being made up into fittings. Pipe shall have round edges or burrs removed so that a smooth and unobstructed flow will be obtained.

C. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, Rector- Seal #5, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Teflon tape may be used on piping smaller than 2 inches.

D. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.

E. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31-1 and B-31-1A.
2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.

3.4 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.
   1. Test steel gas piping with air at 100 PSIG
   2. Test polyethylene gas pipe with air at 60 PSIG

B. Testing equipment, materials, and labor shall be furnished by this **Contractor**.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Purge air from piping systems after testing and repair work has been completed.

3.5 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 22 12 00

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SECTION 22 13 00

FACILITY SANITARY SEWAGE

PART 1 GENERAL

1.1 SUMMARY

A. This section includes piping required for the Sanitary Sewage system.

1.2 REFERENCES AND STANDARDS

A. Requirements of Regulatory Agencies: **Contractor** to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, **Contractor** to provide the more stringent.

1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.3 ACTION SUBMITTALS

A. Submit manufacturer's catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.
2. Indicate all options being submitted

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project

1.6 WARRANTY

A. Manufacturer: In addition to the **Contractor**'s Standard Guarantee, furnish Owner with manufacturer's warranty for all sanitary sewage piping and accessories against defects in materials and workmanship. Warranty shall cover replacement of all such piping systems or accessories plus labor to install.

PART 2 GENERAL

2.1 GENERAL:

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and temperature ratings, and capacities as indicated. Materials and products to comply with the California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.

1. **Contractor** to provide submittal information on material which is to be installed.
2. Where more than one material is indicated, the **Contractor** shall only install one material per system and materials shall not be mixed within the same system.

C. Soldering Materials: Joints in copper tubing for all installations shall be made with brazing alloy sil-fos, or equal. Clean surfaces to be jointed shall be free of oil, grease, rust, and oxides.

1. Harris Stay-Safe 50 solder, or equal, may be permitted on plumbing lines above slab or ground only with prior review for piping sizes 2 inches and smaller only. Solders used shall contain no lead.

2.2 PIPING AND FITTINGS:

A. Sanitary Sewer Piping:

1. Cast iron, no-hub soil pipe. Provide with neoprene sleeve gaskets and stainless steel 4 band couplings.
2. Cast Iron Hub and Spigot Soil Pipe and Fittings: CISPI Standard 301 (Latest Edition) and ASTM A 74.
3. Sanitary Sewer couplings to be super-duty type in conformance with Factory Mutual Standard 1680, Class I and/or ASTM C 1540.
    a. Couplings to be as follows: “Husky” SD4000, Orange Shield coupling as manufactured by Husky Technologies, or equal. Minimum Shield thickness to be 0.015”.
    b. No-Hub Cast-Iron Soil Pipe Couplings: Couplings for use in connection with no-hub Cast Iron Soil Pipe and Fittings shall comply with CISPI 310. Shield and clamp assembly shall consist of a 300 series stainless steel corrugated shield, stainless steel bands (4-bands minimum), and sealing sleeve in conformance with ASTM C564.
4. At **Contractor**'s option, Type DWV hard drawn copper tubing with cast bronze solder joint fittings and lead free solder may be used above ground in lieu of cast iron drainage fittings. Provide test tees as specified.
5. Acceptable manufacturer’s
    a. Tyler pipe
    b. AB&I
    c. Or Equal

B. Sanitary Vent Piping:

1. Cast iron soil pipe and fittings as specified for sanitary sewer piping.

PART 3 EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to **Contractor**.

B. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

C. Locate piping runs, unless detailed otherwise, vertically and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1” clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

D. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

E. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, **Contractor** to make the necessary deviations to the piping system, as determined by the **Contractor**, with the Architect's review, without additional cost to Owner.

F. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

3.2 INSTALLATION OF SANITARY DRAINAGE SYSTEMS:

A. Make joints between PVC pipe and cast-iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

B. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4-inch per foot, unless otherwise noted on the plans. Piping shall have invert elevations as shown and slope uniformly between given elevations.

C. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

D. Grade all vent piping so as to free itself quickly of any water condensation.

E. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions and in accordance with CISPI Pamphlet No. 310, latest edition.

F. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees, at minimum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping, and at base of each conductor.

G. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

H. Install drains in accordance with manufacturer's written instructions and in locations indicated. Unless detailed otherwise, install floor drains and floor sinks with lip of drain slightly below finished floor to ensure drainage. Coordinate with other Contractors to ensure that floor slopes to drain.

3.3 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.

1. Test all soil, Waste Drain and Vent Piping with water. Minimum height of standpipe shall be 10 feet above piping being tested. Fill with water to top of highest vent.

B. Testing equipment, materials, and labor shall be furnished by this **Contractor**.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.4 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 22 13 00

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SECTION 23 00 00

MECHANICAL GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL

A. This Section specifies the Division 23 Work coordination requirements with general work provisions.

B. For convenience and reference the Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime **Contractor** and his Subcontractors. In any case, the Prime **Contractor** is responsible to the owner for a complete job.

C. This section consists of General Requirements and Standard Specifications covering certain parts of work under Division 23 and is supplemented by other Division 23 sections covering additional work, requirements, and materials specifically applicable to the work of each section.

1. Requirements of subsequent sections of the specifications, if in conflict with these General Requirements, shall govern.

D. No material installed as part of this WORK shall contain asbestos in any form.

1.2 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. This section is a Division-23 Basic Materials and Methods section and is a part of each Division -23 section.

1.3 DESCRIPTION OF REQUIREMENTS

A. Provide finished work, tested and ready for operation including apparatus, appliances, materials, and work. Provide incidental accessories necessary to make the work complete and ready for operation without additional expense to the Owner.

B. Before beginning work or ordering materials, consult Architect for clarification of discrepancies between, or questionable intent, of the Contract Documents.

C. **Contractor** shall visit the site and field survey the existing site conditions prior to bid. Any site conditions which may cause significant deviation from the design drawings shall be brought to the attention of the Owner's representative for clarification prior to bid.

1.4 REQUIREMENTS OF REGULATORY AGENCIES:

A. Provide work and materials in full accordance with the latest rules and regulations of the following:

1. California Code of Regulations - Title 24 - Parts 2, 3, 4,5, and 9
2. California Code of Regulations - Title 22 - Chapter 7

3. California Building Code
4. California Mechanical Code
5. California Plumbing Code
6. California Electric Code
7. California Fire Code
8. California Building Energy Efficiency Standards
9. California Green Building Standards
10. California Energy Code
11. National Fire Protection Association
12. CAL-OSHA
13. Occupational Safety and Health Administration
14. State Fire Marshal, Title 19 CCR
15. Other applicable state laws
16. Office of Statewide Health, Planning and Development

Code edition for the above shall be as noted on the drawings and as adopted by the California Division of the State Architect.

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes.

C. Conform to State of California Energy Conservation Standards for all systems, equipment, and construction.

D. The above Codes and Standards define minimum requirements required for the project. Where Contract Documents differ from governing codes, furnish and install higher standard.

1.5 FEES, PERMITS, AND UTILITY SERVICES

A. Arrange for required inspections and permits required in installation of the work.

B. The Owner will pay charges for permits required.

C. Obtain the first permits to operate any compressed air tanks that are required to be furnished under this work, pay all costs, and perform all tests required to obtain permits. Post permits under glass in a conspicuous place on or near the tanks, as required by these authorities.

1.6 SITE EXAMINATION

A. Examine site, verify dimensions and locations against Drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

C. Exercise care in excavating near existing utilities to avoid any damage thereto. This **Contractor** is responsible for any damage caused by his operations.

1.7 ACTION SUBMITTALS / MATERIAL LIST AND SUBSTITUTIONS

A. Prior to commencement of work, and within 35 days after award of Contract, submit to Architect for review electronic copies of a complete list of equipment and materials to be furnished, including all substitutions. All submittals to be in electronic format as follows:

1. Submittals to be in PDF Format.
2. Individual PDF cut sheets shall be inserted into a single file for review.
3. All sheets to be “unprotected” and writable.

B. Provide submittal information for all materials proposed for use as part of this project. Provide standard items on specified equipment at no extra cost to the contract regardless of disposition of submittal data. Other material or methods shall not be used unless approved in writing by the Architect. The Architect’s review will be required even though “or equal” or synonymous terms are used.

C. It is the responsibility of the **Contractor** to assume all costs incurred because of additional work and/or changes required to incorporate the proposed substitute into the project including possible extra compensation due to the Architect. Refer to Division 1 for complete instructions.

D. **Contractor** to provide complete Submittal packages for each system. At a maximum, submittals to be broken into the following packages:

1. Mechanical – Wet Side package including: Piping, valves, source equipment, pumps, accessories, etc.
    a. When required by schedule, a separate Mechanical Underground submittal package will be reviewed upon request.
2. Mechanical –Equipment (e.g.: Packaged AC Units, Exhaust Fans, Air Handling Units, etc.)
3. Mechanical – Building Automation System
4. Mechanical – Piping coordination shop drawing package.
5. Mechanical – Seismic Shop Drawings
    a. Seismic Shop drawings to show bracing requirements and locations as required by Mason OPM-0043-13.
    b. Seismic shop drawings are submitted whether bracing is required or not. Where bracing is not required, drawings shall be submitted with a statement stating that systems have been reviewed and, no seismic supports are required.
2. Incomplete submittals or submittals broken down by spec section shall be returned un-reviewed.

E. Identify each item by manufacturer, brand, trade name, model number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment.

1. Where submittal sheets indicate more than one product, **Contractor** to clearly identify product being submitted. **Contractor** to cross-out information not being submitted for review.

2. Submittals that do not clearly identify submitted item will be returned to the **Contractor** un-reviewed.

F. Identity each submitted item by reference to specification section number and paragraph in which item is specified. Cross reference submittals by equipment ID where applicable.

G. Quantities are the **Contractor**'s responsibility and will not be reviewed.

H. If **Contractor** desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified.

1. Only one request for substitution will be considered on each item of material or equipment. No substitutions will be considered thereafter.

2. Scheduled Products and first named manufacturer/product forms basis of design. All other manufacturers' products are substitutions.

3. No substitutions will be allowed unless requested and reviewed in writing.

4. The Architect shall review and take appropriate action on shop Drawings, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the **Contractor**.

5. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the **Contractor**, nor shall the Architect be required to review partial submissions or those for which submissions for correlated items have not been received. Architect reserves right to require originally specified item.

6. Named non-basis-of-design manufacturer does not guarantee approval of equipment submittals. Manufacturers must comply with all the performance and features as specified within the specifications and as indicated on the design documents.

I. Installation of reviewed substitution is **Contractor**'s responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the owner. Review by the Architect of the substituted equipment and/or dimensional Drawings do not waive these requirements.

1.8 CLOSEOUT SUBMITTALS / MAINTENANCE AND OPERATING INSTRUCTIONS

A. Instruct the Owners' authorized representatives in the operation, adjustment, and maintenance of all mechanical equipment and systems. Provide PDF copy of certificate signed by Owner's representatives attesting to their having been instructed.

B. Furnish Architect with PDF complete sets of operating and maintenance (O&M) instructions.

1. O&M manuals to be scanned and provided in an organized PDF file.

2. O&M manuals to include: descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every mechanical system and piece of equipment furnished under these specifications.

3. Include in each set a copy of the air balance test report specified hereinafter.

C. **Contractor** must start compiling the above data (including obtaining operating and maintenance instruction data and catalog cuts and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation of the work.

D. Final observation will not be made until booklets are submitted and have been reviewed by the Architect.

E. O&M manuals to incorporate the following:

1. Complete operating instructions for each item of heating, ventilating and air conditioning equipment and associated piping and ductwork systems.

2. Test data and system balancing reports as specified.

3. Temperature control diagrams and literature.

4. Manufacturer's bulletins with parts numbers, instructions, etc. for each item of equipment. Remove information not applicable to project.

5. Typewritten maintenance instructions for each item of equipment listing in detail the lubricants to be used, frequency of lubrications, inspections required, adjustment, etc.

6. A complete list and/or schedule of all major valves giving the valve ID, location of valve, and the rooms or area controlled by the valve.

7. Provide copies of start-up reports for each piece of mechanical equipment provided as part of this work.

8. Name, address, and phone number of contractors involved in work under this Division.

9. Detailed step-by-step instructions for starting, summer operation, winter operation, and shutdown of each system.

10. Detailed maintenance instructions for starting, summer operation, winter operation, and shutdown of each system.

11. Spare parts list.

12. Full size Record as built shop drawings in hard copies and PDF files.

13. Full size Record as built shop drawings in hard copies and in AutoCAD 2018 CAD files.

    a. **Contractor** to incorporate field mark-ups into record drawings. Mark-up shop drawings not acceptable.

1.9 COORDINATION SHOP DRAWINGS

A. General:

1. Prepare and submit for review coordination drawings where work by separate entities requires fabrication of products and materials which must accurately interface or for which space provided is limited.

2. Coordination drawings shall indicate how the work will interface and installation will be sequenced. It is the intent of this provision to find, bring forth, and resolve potential constructability problems prior to actual construction, thereby allowing for the resolution of issues before construction cost and schedule are impacted.

B. The General **Contractor** shall oversee preparation of coordination drawings, assign priority space, and bring to the attention of the Architect any conflicts or interferences of an

unresolved nature found during preparation of coordination drawings. Expedite conflict or interferences and submit solutions/ recommendations for approval review.

C. Drawings: Shop drawings shall include but are not necessarily limited to the following:

1. Submit 1/4" = 1'-0" minimum scale, a combined, comprehensive mechanical coordination drawing. Coordination drawing shall include all ductwork, mechanical piping. Drawings to be coordinated with plumbing, sprinkler systems, and ceiling systems overlaid on structural frame and architectural plan. Shop drawings are to be coordinated with all electrical and Telecom systems.
2. Criteria: Ductwork, mechanical piping, plumbing, and sprinkler system components shall be sized as shown on Drawings. Seismic restraints shall be shown where required. Nonconforming Mechanical work installed within designated coordination areas is subject to removal and replacement by the installing **Contractor** at no additional cost to Owner.
3. Provide sections for congested areas.
4. Identify typical areas, start preparation of coordination drawings for such areas first.

D. Where required for coordination purposes, **Contractor** to modify duct shape to an equivalent flattened size at no additional cost to the owner. **Contractor** to limit duct aspect ratio to 3:1 unless provided special written permission by the Architect.

E. Coordination drawings shall be signed and dated by individual trade contractors. By act of signature and submittal of singular combined coordination drawing, each trade **Contractor** acknowledges their coordinated portion of the work with all other mechanical, electrical, telecom, architectural, and structural work contractors.

F. After completion of coordination shop drawings signed by individual trade contractors. Submit copies to the architect for review. Once approved, provide copy at the job site for reference. No work shall be performed without the complete coordination shop drawings.

G. No request for information regarding the routing of pipes, ductwork and placement of equipment will be reviewed and responded to without a completed shop drawings.

1.10 SITE CONDITIONS

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

1.11 WARRANTY

A. Be responsible for work done and material installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show damage to itself or other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

C. Provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

D. Warranties shall be for a period of 2 years from the date of substantial completion unless more stringently specified within individual Sections of this Division.

PART 2 PRODUCTS

2.1 GENERAL

A. Mention herein or on Drawings requires that this **Contractor** provide each item listed of quality noted or equal. Refer to subsequence division 23000 specification sections for specific equipment and system materials and accessories.

B. All material shall be new, full weight, standard in all respects, and in first- class condition.

C. Provide materials of the same brand or manufacture throughout for each class of material or equipment wherever possible.

D. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.

E. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect.

F. Conform to the State Energy Conservation Standards for all material and equipment.

2.2 MATERIALS FURNISHED

A. Identify all materials and equipment by manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new equipment. Variance from this permitted only with written consent of the Architect.

D. Deliver, Protection, and Care:

1. Deliver materials or equipment to the Project in the manufacturer's original, unopened, labeled containers.

2. Added costs associated with reordering, expediting orders, or project delays due to rejected materials shall be borne by the **Contractor**.

3. Protect from damage which may be caused by theft, weather, and building operations. Failure to protect materials and apparatus adequately shall be sufficient cause for rejection of any damaged material or equipment.

4. Close pipe and equipment openings to prevent intrusion of obstructions and damage.

5. Owner or Architect will require removal and replacement of such material or work from the premises which is not in accordance with Contract Documents. Replace unsatisfactory work without delay, at no additional cost to the Owner.

6. All material and equipment shall be protected against moisture, dirt and damage. Protective coverings shall be provided for bearings, open connections to pumps and tanks, coils, ducts, pipes and similar equipment that is vulnerable to grit and dirt.

7. The interior of the pipes and ducts shall be kept clean at all times.

PART 3 EXECUTION

3.1 GENERAL

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on Drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work. Provide all offsets as required to avoid other trades at no additional cost to the owner.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This shall not be cause for additional cost.

C. Execute any work or apparatus shown on the Drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from Drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this **Contractor** from furnishing same in place complete.

D. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

1. Minor piping associated with instrumentation and control is generally not shown. Interconnection of sensors, transducers, control devices, instrumentation panels, combustion control panel, burner control panels is the responsibility of the **Contractor**. Small piping associated with water cooling, drips, drains and other minor piping may not be shown to avoid confusion in the plan presentation but shall be provided as part of contract work. Drains shall be piped to the nearest floor drains.

E. Furnish materials and work at proper time to avoid delay of the work.

F. Coordinate with testing and balancing **Contractor** to review drawings for proposed additional balancing components required for proper system testing and balancing.

3.2 ACCESS

A. Continuously check Architectural Drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of **Contractor** to foresee means of installing his equipment into proper position.

3.3 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make

repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.4 PROJECT MODIFICATIONS

A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this project, such alterations shall be immediately called to the attention of the Architect. **Contractor** shall then prepare necessary Drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.

B. Two sets of Drawings showing all revisions shall be immediately presented to Architect for his records. Maintain additional copies on the project as necessary to comply with "RECORD DRAWINGS" requirement of the General Requirements.

C. Incorporate all revisions into record Drawings.

3.5 FORMING, CUTTING AND PATCHING

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this **Contractor** fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this **Contractor** is responsible.

C. This **Contractor** is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this **Contractor**. Repair or replace damage to existing work with skilled mechanics for each trade involved in first-class manner.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices will not be allowed.

F. Core openings through existing construction as required for the passage of new piping and conduits. Cut holes of the minimum diameter to suit size of pipe installed and associated insulation.

3.6 DEMOLITION AND SALVAGE

A. Provide demolition of mechanical work under this SECTION as indicated on Drawings.

B. Removed materials which will not be re-used 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 the premises. Carefully remove materials claimed by the owner to prevent damage. Coordinated delivery of such items to owner.

C. Removed materials which are to be reused are to be removed, cleaned, and stored in a safe location. If such items are lost or damaged by the **Contractor**, item shall be replaced with new item at no added cost to owner. If item is found to be damaged prior to removal, inform Architect prior to removal so that item may be examined by Architect and owner for further instructions.

3.7 WELDING FOR MECHANICAL WORK

A. All mechanical welding and inspection requirement shall be in accordance with the California Mechanical Code.

B. Qualify welding procedures, welders and operators shall be in accordance with ASME boiler and pressure vessel code, section IX, welding and brazing qualifications. Welding procedures and testing shall comply with ANSI standard B31.9 - standard code for pressure piping, and the American Welding Society (AWS) welding handbook.

C. Soldering and brazing procedures shall conform to ANSI B9.1 standard safety code and NFPA 99.

D. All welders shall be certified by a state approved welding bureau. Fabricator shall have current and valid certificated registration by the building official for the types of welds required by the project. Prior to start of the project, the fabricator shall submit a copy of certificate of registration for approval. Prior to project close out, the fabricator shall submit a certificate of compliance that the work was performed in accordance with the approved plans and specifications to the building official and to the Engineer or Architect of record.

3.8 EXISTING SERVICES

A. Provide and install all required connections to existing systems as required by the Drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 72 hour notice to Owner of service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours at no additional cost to owner.

3.9 STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-16. Chapters 13, 26, and 30.

B. Provide seismic sway bracing for all suspended piping in accordance with the OSHPD anchorage pre-approval OPM-0043-13 the “Mason West Inc. Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”.

3.10 WARRANTY

A. Be responsible for work done and material installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show damage to itself or other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

C. Provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

D. Warranties shall be for a period of 1 year from the date of substantial completion unless more stringently specified within individual Sections of this Division.

3.11 START-UP PROVISIONS FOR MECHANICAL WORK

A. General: Major equipment (such as air handling units, boilers, and chillers) start-up shall be performed by the equipment manufacturer or authorized representative.

B. Adjusting and Aligning Equipment: Adjust all equipment. Check all motors for proper rotation.

C. Lubrication:

1. Extend grease fittings on bearings to points of ready and easy accessibility.
2. Lubricate fan bearings, etc., before operation of any equipment.
3. Provide a final lubrication to equipment immediately before turning over to Owner.

D. Upon completion of the mechanical work, or at such time prior to completion as may be determined by the Architect, operate and test all mechanical equipment and systems to demonstrate the satisfactory overall operation of the building or project as a complete unit. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install new air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests. Test equipment and systems for a minimum as follows:

1. Packaged AC Units (under 20 tons), ductless split systems: 2 consecutive 8-hour days
2. Boilers, chillers, hydronic systems: 5 consecutive 8-hour days.

E. Provide training and orientation of Owners operating staff in proper care and operation of equipment, systems and controls.

F. Neatly tabulate and deliver to the Architect complete operational data, including air flows, room temperatures, fan speeds, motor currents, plenum and duct static pressures, and other data as required. The Architect reserves the right to spot check results, and if discrepancies or errors are noted, **Contractor** will be required to redo balancing tests and tabulations entirely.

G. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.

H. Mark final positions of balancing valves after balancing is complete.

I. All areas of building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

J. Final observation will not be made until all of the above have been completed and a preliminary copy of the balance report has been submitted and reviewed.

3.12 POST-CONTRACT COMPLETION TESTS

A. If the required full-load operation conditions cannot be obtained at the time of the Project Completion Tests due to outdoor seasonal temperatures, return to the job site when requested by the Architect and complete proper loading of equipment and systems as required. Changing of any air filters will not be required under these tests. **Contractor** will be allowed seven calendar days after notification to begin tests.

3.13 PRE-SEASON START UP

A. When requested by the Owner within one year of the filing of Notice of Completion, and when full-load tests required under Project Completion Tests and Post Contract Completion Tests have not been performed, start up any equipment or systems required for heating or cooling season operation by the Owner when such equipment and systems have remained shut down immediately after the Project Completion Tests. Make proper assurance that all equipment and systems are operating properly before being turned over for the first operational use of the Owner within one year of filing of Notice of Completion. The changing of any air filters will not be required under these start-up requirements. The **Contractor** will be allowed seven calendar days after notification, to begin test.

3.14 MECHANICAL RECORD AS-BUILT DRAWINGS

A. During the course of Project Construction, Mechanical **Contractor** shall maintain recorded "AS-built" information by distinctively marking up approved shop drawings prints to depict all actual work installed on a daily basis form but not limited to field conditions, addendums, architectural supplemental instructions (ASIs) , instruction bulletins (IBs), change orders (COs), responses to Request For Information (RFIs), and approved product substitutions.

B. The marked-up shop drawings will be made available at the Construction Site to the Architect upon request, at any time.

C. The marked-up shop drawings with the recorded information shall then be used to create Record As-built drawings at the completion of the project. **Contractor** shall submit the Record As-built drawings in full size hard copies and also in CAD files format using the AutoCAD 2013 or later version.

1. Hand marked shop drawings are not acceptable.
2. Provide 2 complete sets of full-size drawings on 20 pound white bond paper.
3. Provide 1 CD (compact disc) or Thumb Drive with Record drawings in both PDF and AutoCAD, version 2013 or later version.
4. Record as-built drawings are to be full size drawings (same size as Contract Documents) and all plans are to be to standard engineering scale. The minimum drawing scale to match those provided within the Contract Documents.

D. Record As-built drawings shall include the followings:

1. Work on Record As-built drawings shall be provided with horizontal and vertical dimensions. Underground work shall be provided with invert elevations. All dimensions shall be references to permanent building fixed points and/or column lines.
2. Provide sufficient details and sections to depict actual installations.
3. Equipment identifications and system labeling nomenclatures shall match the Project Design Documents.
4. Identification of main shut-off valves shall be based on the approved valve tag list and as actually installed in field.
5. Ductwork mains and branches, size and location with duct elevation information.
6. Locations of all dampers, including but not limited to balancing dampers, fire dampers, combination fire and smoke, air inlets and outlets, terminal units reheat coils, humidifiers, duct access doors and ceiling access panels.
7. Piping mains and branches, size and location with pipe elevation information and invert elevations for underground piping.

8. Locations of all manual and automatic valves, pipe strainers, expansion joints and compensators, pipe guides and anchor points, steam traps and air vents.
9. Equipment locations with dimensions from prominent building lines and required service access.
10. Seismic bracing information for ductwork, piping and equipment.
11. Locations of control system panels, control power transformer panels miscellaneous relay panels, control workstations, routing of control system communication loops.
12. Locations of all installed instruction and control field devices in occupied space and above ceiling including but not limited to thermometers, pressure gauges, flow meters, airflow stations, temperature sensors, differential pressure sensors, thermostats and humidistats.

3.15 CLEANING UP

A. Remove tools, scaffolding, surplus materials, barricades, temporary walks, debris, and rubbish from the Project promptly upon completion of the work of each Section. Leave the area of operations completely clean and free of these items.

END OF SECTION 23 00 00

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SECTION 23 05 00

COMMON WORK FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. This section includes general mechanical materials and methods required within the project. Items included within this specification section include:

1. Roof Flashing
2. Dielectric Unions
3. Thermometers
4. Gauges
5. Pipe and Equipment Identification
6. Motors
7. Motor Starter, Switches, And Wiring
8. Fireproofing
9. Painting
10. Concrete
11. Excavating And Backfill
12. Electrical Work
13. Commissioning and preliminary operational tests

1.2 ACTION SUBMITTALS

A. Product data: submit complete data of materials proposed including:

1. Manufacturer and model number
2. Clearly indicate all options, trim, and accessories.
3. Cross reference manufacturer’s cut sheet to specification section on submittal sheet.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: where applicable, submit complete O&M data including:

1. Maintenance data and parts lists for each component.
2. Provide "trouble- shooting" maintenance guide
3. Include this data within maintenance manual

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

PART 2 PRODUCTS

2.1 ROOF FLASHING

A. Flashings in metal deck or membrane type roofing:

1. Flashing for penetrations of the roof for mechanical items such as flues, ducts, and pipes will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the mechanical work.
2. Furnish and install counter-flashings above each flashing required in the mechanical work. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped to the flue or duct above the flashing.

B. Flashing in built-up roofing assemblies:

1. Where flashing is not provided and installed as part of other Work, furnish and install a waterproof flashing and counterflashing for pipe, duct, and flue passing through roof. The flashing shall extend a minimum of 9 inches in all directions from the outside of the pipe, flue, or duct.
2. Flues shall have 24-gauge galvanized steel flashings on all roofs. Securely clamp a storm collar (counterflashing) around the flue above the flashing. Storm collars shall be of same material as flashing.
3. Seal all pipes, flues, or ducts passing through exterior walls in an approved, watertight manner.

2.2 DIELECTRIC UNIONS

A. Furnish and install dielectric unions at all locations described herein, whether shown on Drawings or not, and except as noted herein. Construct couplings and flanges so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic plastic threaded in standard pipe sizes. Make up the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

B. Acceptable Manufacturers:

1. Watts Regulator Co.
2. Eclipse, Inc.
3. Perfection Corp.

2.3 THERMOMETERS

A. General:

1. Thermometers shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not
2. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type.

3. All thermometers shall be round, stainless steel case construction with glass front.
4. Accuracy to be within plus or minus one of the smallest scale divisions throughout the entire range.
5. The thermometer scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.
6. The thermometers shall be located so as to be easily read and shall be furnished with adjustable angle pattern so as to be rotated to any position.
7. Liquid thermometers for tanks and similar equipment shall have a minimum 5-inch diameter face.
8. Thermometers for piping shall have a minimum face diameter of 3 inches.
9. Thermometers installed on insulated tanks or piping shall be provided with an extension neck well to compensate for the thickness of the insulation.
10. Thermometers shall be provided with stainless steel stems and steel wells.
11. Thermometers used for air temperature in ductwork, plenum boxes, etc., unless specified or shown otherwise, shall have a minimum scale face of 5 inches and shall have an adjustable mounting flange so that scale may be set at any angle up to 45 degrees to facilitate reading.
    a. The thermometers shall have a perforated guard over stem suitable for sensing air temperature.
    b. Length of stem shall be a minimum of 8 inches.
12. Thermometer wells with chain and cap shall be provided where wells are indicated on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:
1. Weston
2. Marsh
3. Taylor
4. Or Equal

2.4 GAUGES

A. General:
1. Gauges and gauge connections shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not.
2. Accuracy to be within 1 percent in the middle third of the dial range and equipped with front calibration.
3. Dials to be white with black numerals.
4. Normal reading to be mid-scale.
5. Provide a needle valve on each gauge connection.
6. Gauge to have bronze bushed movement and front recalibration.
7. Gauges shall have a minimum dial size of 3-1/2 inches.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:

1. Marsh, Series J
2. U.S. Gage
3. Danton 800

2.5 PIPING AND EQUIPMENT IDENTIFICATION

A. Pipe Identification:

1. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by a prefabricated coiled plastic colored label.
2. Labels shall comply with ASME A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule shown in this Article.
3. For use indoors use 20 mil vinyl labels, MSI model MS-970, or equal. For piping with an outside diameter greater than 6 inches provide the label manufacturers nylon straps to secure label to piping.
4. For use outdoors use Polyester/Tedlar laminated material, MSI model MS-977, or equal. For piping with OD greater than 6" provide the label manufacturers stainless steel straps to secure label to piping.
5. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors easily discernible.
6. Acceptable Manufacturers:
   a. Marking Services Incorporated (MSI)
   b. Idento Metal Products Co., Idento Bands
   c. Setmark

B. Equipment Identification:

1. Provide white lamacoid plate for each and every piece of equipment installed in this work.
   a. Lettering on plate shall be black, with size of lettering to suit equipment.
   b. Lettering shall be minimum of 3/8-inch in height.
   c. Plates shall be riveted or bolted to equipment.
2. Equipment to include, but not limited to:
   a. Air Handling Units
   b. Exhaust Fans
   c. VAV / CAV Boxes
   d. Split Systems AC Units
   e. Boilers
   f. Chillers
   g. Pumps

h. Air Compressors

i. Etc.

C. Acceptable Manufacturers:

1. Marking Services Incorporated, (MSI)
2. LEM Products
3. Seton
4. Craftmark

2.6 ELECTRIC MOTORS

A. General:

1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

B. Electric Motors:

1. All electric motors shall comply with requirements of NEMA, UL, ANSI/IEEE 112 and NEC, suitable for intended load, voltage, phase, frequency, service, and location.
2. Limit maximum motor speeds to 1750 rpm, unless otherwise specified.
3. Motors 1/2 HP and larger shall be 3 phase, 60 Hz, squirrel cage induction motors unless specifically specified to the contrary in subsequent Sections of this Division.
   a. Refer to Drawings for voltage requirements.
   b. Totally enclosed motors rated 3/4 HP, 1200 rpm, or 1 HP and larger, and all drip-proof motors shall have a 1.15 continuous-duty service factor at 40^{o}C ambient temperature.
   c. Insulation system shall be NEMA Class F or better.
   d. Provide double-shielded, grease-lubricated ball bearings with grease pockets on each side for regreasing in service.
   e. Provide inlet and outlet grease connections in 7.5 HP and larger motor housings for each bearing.
   f. Motors 5 HP and smaller and all roof-mounted equipment motors shall be provided with factory sealed, permanently lubricated ball bearings.
4. Motors smaller than 1/2 HP shall be single phase, 110 volt permanent split-capacitor type with integral thermal overload protection. Bearings shall be factory sealed, permanently lubricated ball type.
5. Provide totally enclosed motors, or suitable protection per NEMA Standards, in locations exposed to the weather or dripping water and in air handling units downstream of cooling coils and heat recovery coils. Other motors shall be open drip-proof.
6. Multi-speed motors shall be provided where specifically scheduled.
7. Motors feed by variable frequency drives (VFD) shall be specifically designed by motor manufacturers for variable frequency drive application.

8. Minimum Efficiency and Power Factor: Minimum Power Factor shall be 85 percent minimum, in all sizes, and minimum efficiency shall be as follows, for 1,800 rpm motors as tested in accordance with NEMA Table 12-6D. The minimum efficiencies shall be guaranteed. Minimum efficiencies to be as follows:
    a. ≤1 HP - 85.5% efficiency
    b. 1-1/2 HP & 2 HP – 86.5% efficiency
    c. 3 HP & 5 HP – 89.5% efficiency
    d. 7.5 HP & 10 HP – 91.0% efficiency
    e. 15 HP – 92.4% efficiency
    f. 20 HP – 93.0% efficiency
    g. 25 HP & 30 HP – 93.6% efficiency
    h. 40 HP – 94.1% efficiency
    i. 50 HP – 94.5% efficiency
    j. 60 HP – 95.0% efficiency
    k. 75 HP – 125 HP – 95.4% efficiency
9. Overload protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
10. Noise rating: Comply with ANSI/NEMA MG 1."Quiet" rating on motors located in occupied spaces of building.
11. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

C. Acceptable Manufacturers:
    1. Reliance
    2. Baldor
    3. US Motors
    4. Westinghouse
    5. Lincoln
    6. General Electric

2.7 MOTOR STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor Starters:
    1. Magnetic motor starters for equipment provided under the Mechanical Work shall be furnished by the Mechanical **Contractor** and turned over to the Electrical **Contractor** for installation, unless otherwise noted.
        a. Magnetic motor starters shall be provided as part of motor control centers shall be provided and installed by Electrical **Contractor**
    2. Unless otherwise noted, magnetic motor starters shall be furnished in NEMA 4 enclosure for outside installation and NEMA 1 enclosure for inside installation, with three thermal overloads for three- phase motors and one overload element for single-phase motors. All overloads shall be ambient compensated.

3. Furnish single phase motors with manual motor starters having integral overload protection.
4. Furnish 3-phase motors with full voltage, magnetic across-the-line starters unless noted otherwise.
5. Provide thermal overload protection for all 3-phase legs. Provide motor starters with single phase protection.
6. Provide fail-open auxiliary contacts, pre-wired to a terminal strip, for future remote alarm wiring and run-time totalization. Refer to Division 26.
7. Provide equipment starters with an adequate control transformer, complete with fuse protection, to supply 120 volt source for control circuit, regardless of line voltage.
8. Provide hand-off-automatic selector switches in cover.
9. Variable Frequency Drive Controllers: Provided under Section 23 29 23 - Variable Frequency Drive Controllers.

B. Manual switches shall have pilot lights and extra positions for multi-speed motors.

C. Overload protection: Melting alloy type thermal overload relays.

D. Magnetic Starters:
1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
2. Trip-free thermal overload relays, each phase.
3. Interlocks, pneumatic switches, electric relays and similar devices as required for coordination with control requirements of Division 15 Controls Sections.
4. Externally operated manual reset.
5. Under-voltage release or protection.

E. Motor connections:
1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.8 FIREPROOFING

A. Fireproofing to be installed at all pipe and duct penetrations of rated assemblies.

B. Fireproofing to be UL Rated fire stop material.

C. Acceptable Manufacturers:
1. Hilti
2. 3M Pro-Set
3. Or Equal

PART 3 EXECUTION

3.1 ROOF FLASHING

A. Provide pipe flashings as noted on the Drawings.

B. Flue and duct flashings and storm collars shall be securely clamped around flue or duct storm collar or counterflashing, above flashing.

3.2 DIELECTRIC UNIONS

A. Install dielectric unions in the following locations:

1. In all metallic water connections into the building within 5 feet of the building wall. Install adjacent to the shut-off valve or cock and above ground where possible.
2. At points of connections where copper water lines connect to steel domestic tanks and other equipment.
3. At points in piping where dissimilar metal pipes are connected together.
4. Any special applications shown on the Drawings.
5. Where steel or cast-iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast- iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.
6. Where copper or brass piping is connected to steel or cast-iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape extending outward a minimum of 5 feet on all pipes, from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of the tape over the piping. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

3.3 THERMOMETERS

A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb.

B. Enlarge pipes smaller than 2-1/2” for installation of thermometer wells.

C. Apply thermal grease in thermowells prior to installation of thermometers.

D. Where shown on the temperature control diagram, the temperature control subcontractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers. Duct-mounted thermometers may be omitted at these locations.

E. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as follows:

1. 30 to 120 ^{o}F at Air Inlet and Outlet of each bank of heating and cooling coils.
2. 50 to 250 ^{o}F adjacent to each insertion type thermostat installed (hot water) under “Temperature Control”.
3. 50 to 250 ^{o}F at both the water inlet and water outlet of each bank of hot water coils and heat exchangers.

4. 30 to 120 °F at both the water inlet and water outlet of each bank of chilled water coils and heat exchangers.
5. 50 to 250 °F at both water inlet and water outlet of cooling tower.

F. In such cases where the above described thermometers cannot be located so as to be easily read, a remote reading type of thermometer shall be installed, as approved by the Architect.

G. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.4 GAUGES

A. Gauges shall have indication of 0 to 160 psi where indicated pressure will be greater than 40 PSI and 0 to 60 psi for lesser pressures.

B. Provide gauge connections at the following locations:
1. Inlet and outlet of butterfly-type balancing valves.
2. Inlet and outlet of water chiller.
3. Suction and discharge of circulating pump.
4. Elsewhere as may be shown on the Drawings.

C. Gauges shall be provided in a convenient location within approximately 5 feet of the flanges or connections and elsewhere as may be shown on the Drawings.

D. A needle-point globe valve, similar to Crane No. 88, shall be supplied at each gauge and gauge connection.

E. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.5 PIPE AND EQUIPMENT IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. Underground pipe identification shall consist of a buried, continuous, preprinted, bright colored, plastic ribbon cable marker provided for each underground pipe.

C. The legend and flow arrow shall be applied at the following locations:
1. All valve locations,
2. All points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction
3. All exposed locations
4. At approximately 20-foot intervals on pipe runs.

D. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect to meet specific conditions.

E. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

F. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

G. Where different equipment, such as fire sprinklers, are supplied from a common main, such as domestic water, the main should be identified as "Domestic Water" and each respective branch takeoff as "Fire Water," etc.

H. The non-potable water plumbing piping shall be marked with the legend "Danger - Unsafe Water". This legend shall be applied to both hot and cold water systems along the length of the pipe in fluorescent orange at a maximum of five foot intervals.

I. Lettering size and label colors are to be per ASME/ANSI A13.1 Pipe Marking Standards.

3.6 MOTORS

A. Motors furnished in the Mechanical Work shall be furnished by the Mechanical **Contractor**, but such equipment shall be delivered to the Electrical **Contractor** for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical **Contractor**.

3.7 MOTOR STARTERS SWITCHES, AND WIRING

A. Starters located in motor control centers will be provided under the Electrical Work. **Contractor** is referred to electrical drawings for motors served by motor control centers.

B. Starters furnished by the Mechanical **Contractor** to be delivered to the Electrical **Contractor** for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical **Contractor**.

3.8 FIREPROOFING

A. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop.

B. Fireproofing system to be installed in strict accordance with manufacturer’s written instructions and details.

3.9 PAINTING

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Exposed piping and unfinished portions of equipment to be painted shall be cleaned of grease, oil, rust, or dirt in preparation for painting.

C. Where applicable, remove pipe clamps prior to painting so that entire pipe is painted. Provide temporary support as required. Re-install clamps after priming/painting is complete.

D. Priming:

1. **Contractor** to prime all exposed ferrous metals, including piping, which are not galvanized or factory-finished.

    a. Black steel pipe exposed to weather shall be cleaned and primed with one coat of Rust-Oleum, or equal, #1069 primer. Color to be Grey.

E. See Painting Section for detailed requirements.

3.10 CONCRETE

A. Where specifically indicated on the Drawings or specified as part of Mechanical Work, this **Contractor** shall furnish and install concrete work, such as thrust blocks or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for General Construction.

C. Except as noted above, concrete work will be furnished and installed under General Work. This **Contractor** shall coordinate requirements accordingly.

3.11 EXCAVATING AND BACKFILL

A. Perform all excavating required for work of this Section. Do excavating required for installation of piping and service lines and other work that applies as indicated on Drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping. Provide the services of a pipe/cable locating service prior to excavating activates to determine location of existing utilities

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of trench and around pipe as required for caulking, joining, backfilling, and compacting. 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 minimum of 4" deep sand bed to provide a uniform grade and firm support throughout entire length of pipe. For PE gas pipe, bed the pipe in a 4" sand bed.

C. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one-third of pipe. Where rock is encountered, undercut trenches 3 inches and fill with well-tamped, clean sand and pea gravel to correct pipe elevation.

D. After pipe lines in excavation have been installed and tested, backfill excavation to point 6 inches above pipe using sand, fine earth, or other materials free of rocks and large lumps. Proceed evenly on both sides of pipe and continuously tamp. Except as hereinafter noted, backfill above 6 inches above top of pipe shall be made by using earth from excavation placed in layers of 8-inch maximum depth. Compaction of each successive layer will be made with mechanical compactor.

E. Take special care in backfilling over wrapped piping to prevent damage to protective wrapping.

F. This **Contractor** shall replace sod, concrete, asphalt paving, curbs, pavement, walks, and any other type of existing work or surface disturbed by excavation, using workmen skilled in trade involved.

G. When pipe or underground conduit with a protective wrapping is to be placed in the trench, sand only shall be used for bedding the pipe or conduit. The sand used shall be certified to have a minimum resistance of 5,000 ohms per cubic centimeter when wetted to any moisture content with distilled water and shall consist of clean, natural, washed-sand, hard, and durable particles varying from fine particles to particles of such size that all will pass through a 3/8-inch screen, not less than 90 percent will pass through a 1/4-inch screen, and not more than 25 percent will pass through a No. 50 screen.

H. Any backfill placed under this contract which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the **Contractor** by adding compacted backfill or additional paving in paved areas.

3.12 ELECTRICAL WORK

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electric Code and other applicable codes or ordinances. The mechanical work shall be coordinated with the Electrical Work in order to comply with these requirements. Any work which does not conform to these regulations shall be properly corrected without additional cost to the Owner.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical Work by the Temperature Control Sub-**Contractor**, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and push button or other manual starter switch or branch power circuits required for temperature control systems.

C. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the Temperature Control Subcontractor.

D. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at factory before shipment.

E. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Run line and low-voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of Mechanical **Contractor** and shall be of type specified in electrical specifications.

3.13 DEMOLITION

A. Refer to Division 1 sections 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. 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 to be evacuated per EPA requirements.
3. Ducts to be removed: Remove portion of duct indicated to be removed. Cap remaining ducts with same or compatible ductwork material and seal cap air-tight.
4. Ducts to be abandoned in Place: Cap 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 re-installed: Disconnect and cap services and remove, clean, and store equipment. When appropriate, re-install, reconnect, and make equipment operational.

a. If existing equipment which is to be re-installed is damage, contact architect prior to removal. **Contractor** to take pictures of any damaged equipment prior to its removal and submit pictures to Architect.

b. Equipment damaged during removal, storage, or re-installation shall be the **Contractor**'s responsibility and is to be replaced with new at no additional cost to the owner.

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, removed damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Non-Destructive Testing Of Existing Concrete Slabs:

1. When drilling or saw cutting existing reinforced concrete, use care and caution to avoid cutting or damaging the existing reinforcing bars, conduit, or tendons. Use a non-destructive method to locate metals poured into the slab prior to doing any work.

3.14 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

B. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out flush valves, traps, strainers, and pressure-reducing valves.

C. Keep the interior of all ductwork free of dirt, dust, loose insulation, and other foreign materials at all times.

D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

3.15 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.16 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 23 05 00

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SECTION 23 05 23

VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This section describes requirements of Hydronic Piping Systems and their accessories. This section includes:

1. Hydronic Valves
2. Vent Valves
3. Flow Control Valves

1.2 REFERENCES AND STANDARDS

A. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping."

B. UMC Compliance: Fabricate and install hydronic piping in accordance with IAPMO "Uniform Mechanical Code."

1.3 ACTION SUBMITTALS

A. Submit manufacturer’s catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, valve, equipment, etc. indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.
2. Indicate all options being submitted.

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

C. Operation and Maintenance Data: submit complete O&M data including:

1. Maintenance data and parts lists for each component.
2. Provide "trouble- shooting" maintenance guide
3. Include this data within maintenance manual

D. Provide Valve list and half size floorplan(s) showing valve locations and function and valve ID cross-referenced on floorplan.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

1.6 WARRANTY

A. Manufacturer: In addition to the **Contractor**'s Standard Guarantee, furnish Owner with manufacturer's warranty for all plumbing valves and accessories against defects in materials and workmanship. Warranty shall cover replacement of all such valves or accessories plus labor to install.

PART 2 PRODUCTS

2.1 GENERAL

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 ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures or as specified. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems.

2.2 HYDRONIC VALVES

A. General:
   1. Similar valves to be by the same manufacturer.
   2. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
   3. Bronze Valves: 2"Ø and smaller with threaded ends, unless otherwise indicated.
   4. Ferrous Valves: 2 ½" Ø and larger with flanged ends, unless otherwise indicated.
   5. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
   6. Valve Sizes: Same as upstream piping unless otherwise indicated.
   7. Provide Ball valve for pipe sizes 2 ½"Ø and smaller and provide butterfly valve for pipe sizes 3"Ø and larger.
   8. Valve Actuator Types:
      a. Handwheel: For valves other than quarter-turn types.
      b. Hand-lever: For quarter-turn valves 6"Ø and smaller.
      c. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height.
      d. Valves in Insulated Piping: With 2" stem extensions and the following features:
         1) Ball Valves: With extended operating handle of non-thermal-conductive material and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
         2) Butterfly Valves: With extended neck.

9. Valve-End Connections:
    a. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
    b. Grooved: With grooves according to AWWA C606.
    c. Valve solder-joint connections are common in smaller sizes of plumbing piping. Soldering and brazing methods used to achieve required pressure-temperature ratings may damage internal valve parts. Special installation requirements for soldered valves may make threaded valves more cost-effective.
    d. Threaded: With threads according to ASME B1.20.1.
    e. Valve Bypass and Drain Connections: MSS SP-45.

B. Acceptable Manufacturers:
    1. Ball, gate, butterfly, and check valves:
        a. Nibco
        b. Apollo
        c. Milwaukee
        d. Hammond
    2. Balance Valves:
        a. Bell and Gosset Circuit Setter
        b. Armstrong
        c. Nibco
    3. Triple Duty Valves:
        a. Bell and Gosset ITT
        b. Taco, Inc.
        c. Armstrong Pumps, Inc.
    4. Pressure Relief Valves:
        a. Watts
        b. Or Equal

C. Ball Valves - ≤ 1 ½"Ø:
    1. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
    2. NIBCO Model S-585-70-66 or equal.
        a. SWP Rating: 150 psig
        b. CWP Rating: 600 psig
        c. Body Design: Two piece steel with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
        d. Body Material: Bronze ASTM B 584 Alloy C844.
        e. Ends: Threaded or Solder.
        f. Seats: PTFE or TFE.
        g. Stem: Stainless.

h. Ball: Stainless steel, vented.

i. Port: Full.

D. Ball Valves – 2”Ø ≤ 2 ½”Ø:

1. Three Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

2. NIBCO Model S-585-70-66 or equal.

a. SWP Rating: 150 psig

b. CWP Rating: 600 psig

c. Body Design: Three piece steel with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.

d. Body Material: Bronze ASTM B 584 Alloy C844.

e. Ends: Threaded or Solder.

f. Seats: PTFE or TFE.

g. Stem: Stainless.

h. Ball: Stainless steel, vented.

i. Port: Full.

E. Check Valves – - ≤ 3”Ø:

1. Horizontal Swing, Regrinding type, Y-patter, Renewable seat and disc bronze check valve

2. NIBCO Model T-413 or equal.

a. SWP Rating: 125 psig

b. CWP Rating: 200 psig

c. Body Material: Bronze ASTM B 62.

d. Ends: Threaded

e. Seats: Buna-N.

f. Hinge: Bronze ASTM B140 Alloy

F. Butterfly Valves- 3”Ø and larger:

1. Extended neck, geometric drive, molded-in seat liner, lug and wafer style butterfly valve.

2. NIBCO Model T-480 or equal

3. Valves shall be lug or I.P.S. grooved body style manufactured in accordance with MSS-SP67;

a. CWP Rating: 200 psig

b. Body: Ductile Iron ASTM A536

c. Disc Aluminum Bronze ASTM B148 Alloy 954/955

d. Stem: Stainless Steel

e. Stem and Body Seal: EPDM Rubber

f. Body to have 2" extended neck for insulating

g. Body: ductile iron. Valve to have aluminum bronze alloy

G. Triple-Duty Valve:

1. Provide triple-duty valve where shown on drawings. Valve shall provide shut-off, flow control, non-slam check, and flow metering valve functions.
2. Construction: Cast or ductile iron body with non-slam bronze seat dish with EPDM seat insert, stainless steel stem and spring, and non-asbestos Teflon impregnated packing. Valve shall be rated at a working pressure of 125 psi. Provide with flanged end connections.
3. Valve shall be fitted with shrader valve metering connections, memory indicators to allow the valve to be returned to balance position after shut-off, and scale for rough balance setting.

H. Air Vent Valve:

1. Automatic Air Vent Valves: Hoffman No. 79, or equal. Pipe vents to drain to floor sinks.
2. Manual Air Vent Valves: Air vents shall be furnished as detailed on Drawings complete with ball valve. Globe valve pressure ratings shall be as required for system on which installed.

I. Water Relief Valves:

1. Provide water relief valves as indicated, of size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210^{o}F and pressure relief at 125 psi.
3. Pressure Relief Valves: Watts Series 740, or equal, bronze body, test lever, ASME rated. Provide pressure relief at 30 psi above operating pressure.

PART 3 EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which hydronic piping systems and specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment, valves, etc. per manufacturer’s written instructions and per industry standards.

C. Provide manual air vents at all high points in heating water, chilled water, and condenser water piping.

3.2 INSTALLATION OF VALVES

A. Valve Applications:

1. Hydronic Heating and Chilled Water:
   a. Shut off valves above grade: Ball Vales or Butterfly Valves
   b. Shut off valves below grade: Gate Valve
2. Check Valves:
   a. Piping in horizontal orientation: Swing Check Valve

b. Piping in vertical orientation: Lift Check Valve

B. General:

1. Install valves with stems upright or horizontal. Valves stem position to be arranged to allow access for maintenance.
2. Do not install swing check valves in vertical position.
3. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
4. Operate valves in positions from fully open to fully closed prior to installing within system.
5. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
6. Locate valves for easy access and provide separate support where necessary.
7. Install valves in horizontal piping with stem at or above center of pipe.
8. Install valves in position to allow full stem movement.
9. Install check valves for proper direction of flow and as follows:
   a. Swing Check Valves: In horizontal position with hinge pin level.
   b. Lift Check Valves: With stem upright and plumb.
10. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
11. Provide union at each connection to equipment and downstream of each valve. Provide unions at both ends of valves when valves cannot be turned due to an obstruction.
12. After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
13. Tag each valve and provide a complete listing of valve locations and functions.
14. Provide additional tag at each valve noted below. Tag shall be black plastic with white lettering, 3-ply, 125 mil thick, Minimum 3” square.

C. Drain Valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere as indicated or required to completely drain hydronic piping system.

D. Balance Valves: Install balance valves on each hydronic terminal and elsewhere as indicated. After hydronic system balancing has been completed, mark each balance valve with stripe of yellow lacquer across body and stop plate to permanently mark final balanced position.

E. Vent Valves:

1. Manual Vent Valves: Install manual vent valves on each hydronic terminal at highest point and on each hydronic piping drop in direction of flow for mains, branches, runouts, and elsewhere as indicated.

2. Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain or as indicated.

3.3 ADJUSTING AND CLEANING

A. Clean, flush, and inspect hydronic piping systems in accordance with requirements of Division-23-05-00 Common Work Results for Mechanical sections.

3.4 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.5 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.6 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly

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SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes insulation types and thickness for mechanical piping, ductwork, and equipment.

1.2 REFERENCES AND STANDARDS

A. California Code of Regulations – Title 24, Part 4.

B. California Building Code, California Electric code, NFPA, and UL

C. ASTM

D. ASHRAE

E. NAIMA

F. NFPA

G. SMACNA – Sheet Metal and Air Conditioning **Contractor**'s National Association, Inc.

H. Underwriter's Laboratories

I. GREENGUARD

1.3 ACTION SUBMITTALS

A. Submit complete data of materials proposed.
   1. Indicate individual services for each system.
   2. Indicate proposed insulation thickness for each system
   3. Indicate proposed R-valves, densities, etc. for each product.

B. Provide Manufacturer's installation instructions for each product.

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Submit executed warranty.

B. Certification: Submit Contractors Certification

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firm specializing in manufacturing of mechanical insulation products applicable to project whose products has been in satisfactory use in similar services for a minimum of 3 years.

B. Installer's Qualifications: Company specializing in piping insulation application with a minimum of 3 years experience.

C. Flame/Smoke Ratings: Insulation materials, including but not limited to insulation, jackets, coverings, sealers, adhesives, etc., to have flame-spread rating of 25 or less and smoke-developed index of 50 or less when tested in accordance with ASTM E84.

D. Insulating products to be installed in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

1.6 WARRANTY

A. Manufacturer: In addition to the **Contractor**'s Standard Guarantee, furnish Owner with manufacturer's warranty for insulation against defects in materials and workmanship. Warranty shall cover replacement of insulation plus labor to install

PART 2 PRODUCTS

2.1 GENERAL

A. For purposes of this specification, fittings, joints, strainers, flexible piping, valves, etc. shall be considered as piping and shall be insulated with same material and thickness as adjoining piping unless noted otherwise.

B. Acceptable Manufactures
   1. Knauf
   2. Johns Manville
   3. Certainteed
   4. Owens-Corning

2.2 MATERIALS

A. Fiberglass Piping Insulation:
   1. Insulation to be heavy density fiberglass pipe insulation that complies with ASTM C547.
   2. Insulation to have factory-applied self-sealing vapor barrier.
   3. Maximum K-Value at 75^{o}F = 0.23 Btu-in/hr-FT^{2}-^{o}F.
   4. For pipe sizes 1.5 inches in diameter and larger, provide rigid insulation inserts with galvanized metal shields ("Saddles") at hanger locations.
      a. Shields are not required for pipes 1-1/4" or smaller.
   5. Fittings and valves to be insulated with John Manville Zeston 2000 Series 25/50 Smoke-Safe PVC pre-molded insulated covering secured with standard fasteners.
   6. Insulation to be Johns Manville Micro-Lok HP or equal.

B. Flexible Closed Cell Insulation:
   1. Flexible elastomeric thermal closed-cell structure insulation.
   2. Maximum K-Value at 75^{o}F = 0.27 Btu-in/hr-FT^{2}-^{o}F.
   3. Joints to be sealed with Armstrong 520 Adhesive

4. Insulation to be Armstrong Armaflex 22 or equal

C. Fiberglass Ductwork Insulation:

1. Duct wrap to be blanket-type thermal and acoustical insulation made from glass fibers, bonded with white formaldehyde-free resin, compliant with ASTM C1290.
2. Labeled K-Value to equal 0.29 Btu-in/hr-FT^2-^oF.
3. Compressed K-Value to equal 0.27 Btu-in/hr-FT^2-^oF.
4. Insulation to be Johns Manville Microlite Formaldehyde-Free Faced Duct Wrap or equal or equal.

2.3 PIPING INSULATION

A. Steam Condensate Piping:

1. Insulated exposed and concealed condensate drain piping within building with 2” closed-cell pipe insulation.
2. Seal with Armstrong 520 adhesive.

B. Heating Hot Water:

1. Insulate piping with fiberglass piping insulation with thicknesses as follows:
   a. Pipes 3/4”∅ and smaller - 1 1/2” thick insulation.
   b. Pipes 1” and larger – 2” thick insulation.
2. Exposed piping installed below 9’-0” to be provided with metal protective jacket. Metal protective jacket to be as follows:
   a. Sheet Aluminum: ASTM B209, 3003 allow, H-14 temper, 0.16” thick.
   b. Longitudinal lab to be at least 2” wide.
   c. Fitting covers: Factory fabricated type 3003 sheet aluminum, 0.024” minimum thickness.
   d. Provide stainless steel metal screws spaced at 6” on center for fastening aluminum jacket and fittings. Aluminum ban not acceptable.

2.4 EQUIPMENT INSULATION

A. Air / Dirt Separator

1. to HHW piping insulation requirements applies to the air / dirt separator.

PART 3 EXECUTION

3.1 GENERAL

A. Insulation to be stored on jobsite in clean / dry location. Any insulation exposed to water must be discarded immediately and removed from jobsite.

3.2 INSTALLATION OF PIPING INSULATION

A. Install piping insulation products in accordance with manufacturer’s written instructions and in accordance with recognized industry practices.

B. Installation to be installed after installation of heat tracing, testing, acceptance of testing, and cleaning of pipe.

C. Insulate each continuous run of piping with full-length units of insulation. Cut pieces to size as required. Do not use multiple cut pieces and/or scraps abutting each other.

D. Clean and dry piping surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and type fit over surface to be covered.

E. Install piping insulation without interruption through walls and floors except where otherwise indicated.

F. Taper raw ends of insulation and seal with canvas and sealant as noted for fittings.

G. Install pipe hangers on the outside of the insulation.

3.3 INSTALLATION OF EQUIPMENT INSULATION

A. Clean and dry all surfaces prior to insulating.

B. Install insulation materials with smooth and even surfaces. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting in poor workmanship.

C. Do not apply insulation to equipment breechings or stacks while hot.

D. Do not insulate manholes, handholds, cleanouts, nameplate, ASME stamp. Provide beveled edge at interruptions of insulation.

3.4 INSULATION REPAIR

A. Repair damaged sections of existing and/or new mechanical insulation where damaged occurred during this construction period. Use insulation of same thickness as existing insulation. Install new jacket lapping and seal over existing.

3.5 CARE AND CLEANING

A. Repair and/or replace broken, damaged and or otherwise defective insulation. Work to be completed to the satisfaction of the Architect. At completion of work, clean materials installed as part of this work and leave systems and equipment in satisfactory operating condition.

B. Upon completion of work remove materials, equipment, tools from premises. Leave project area neat, clean and orderly.

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SECTION 23 21 13

HYDRONIC PIPING SYSTEMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. This section describes requirements of Hydronic Piping Systems and their accessories. This section includes:

1. Hydronic Piping
2. Air Separators
3. Expansion Tanks
4. Chemical Feeders

1.2 REFERENCES AND STANDARDS

A. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping."

B. UMC Compliance: Fabricate and install hydronic piping in accordance with IAPMO "Uniform Mechanical Code."

1.3 ACTION SUBMITTALS

A. Submit manufacturer’s catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, valve, equipment, etc. indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.
2. Indicate all options being submitted.

B. Provide Welding and Brazing Certifications. Submit reports as required for piping work applicable to the project.

1. Welders that do not have current Certifications shall not be permitted to weld and/or braze on the project.

1.4 CLOSEOUT SUBMITTALS

A. Record Drawings:

1. At project closeout, submit Record Drawings of installed hydronic piping and piping products in accordance with requirements of Division 1.
2. Include valve list cross-referenced to record drawings in O&M manual.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for Hydronic system
   2. Include this data, product data and Shop Drawings in maintenance manual
   3. Include copies of pressure tests in closeout documentation.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping 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 piping systems work similar to that required of project.

PART 2 PRODUCTS

2.1 GENERAL

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 ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures or as specified. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems.

2.2 HYDRONIC PIPING

A. Above Grade Heating Hot Water and Chilled Water with Pipe sizes 3"Ø and smaller to be as follows:
   1. Copper Tube: ASTM B 88, Type L, hard-drawn temper.
   2. Fittings to be wrot-copper fittings with brazed joints.

B. Above Grade Heating Hot Water and Chilled Water with Pipe sizes 4"Ø and larger to be as follows:
   1. ASTM A53 or ASTM A120 black steel, Schedule 40 pipe.
   2. Fittings to be standard-weight, full-radius, butt-welding fittings and 150-lb., forged-steel, weld-neck type flanges.
   3. Connections to threaded equipment, valves, etc. shall be made with 150-lb., cast-iron, threaded fittings.
   4. Piping 2 inches and smaller shall have 150-lb., screwed, cast-iron fittings.
   5. Slip-on flanges will be permitted where space is limited with prior approval of the Architect. All slip-on flanges shall be back-welded.

6. All underground chilled water and hot water lines with fluid temperatures up to 250 ^{o}F shall be the POLY-THERM type, as manufactured by PERMA-PIPE, or equal.
    a. All straight sections, fittings, anchors and other accessories shall be factory fabricated to job dimensions
    b. Each system layout shall be computer analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe.
    c. Straight sections shall be prefabricated in 20 or 40 foot random lengths, and fittings shall be prefabricated with short tangent lengths attached to simplify field installation. Factory trained technical assistance shall be provided for the critical periods of installation; i.e., unloading, field joint instructions and testing.
    d. The pipe shall be insulated with polyurethane foam and enclosed in an outer jacket of FRP / PVC.
7. Internal piping shall be standard weight carbon steel. All joints shall be butt welded for sizes 2-1/2 inches and greater, and butt welded or socket welded for 2 inches and below. Where possible, straight sections shall be supplied in 20 or 40 foot random lengths with 6 to 8 inches of piping exposed at each end for field joint fabrication.
8. Accessories End seals, gland seals and anchors shall be designed and factory fabricated to prevent the ingress of moisture into the system.
9. Insulation:
    a. Service pipe insulation shall be spray applied .16k-factor, R141B blowing agent, nominal 2 pound per cubic foot density, polyurethane foam for straight sections and preformed polyurethane foam for all fittings. To ensure no voids are present, all insulation shall be inspected by one of the following three methods: visually checked prior to application of the protective jacket or infrared inspection of the entire length 24 hours after foaming is complete. The insulation shall be applied to the minimum thickness specified below. The insulation thickness shall not be less than indicated in these specifications for hot water piping systems:
        1) Pipes 1” to 6” diameter to have 1” thick insulation
        2) Pipes 8” to 14” diameter to have 1-1/2” insulation
        3) Pipes 16”-24” diameter to have 2” insulation.
10. Protective Jacket:
    a. All straight sections of the insulated piping system shall be filament wound, polyester resin/fiberglass reinforcement composite directly applied on the insulating foam. The manufacture shall have the option to filament wind fiberglass directly onto the polyurethane foam or inject foam into a fiberglass outer casing. Fiberglass outer casing allowed shall be A.O. Smith Red Thread or Ameron Bondstrand 3000. Thermoplastic casing material that are not rated for temperatures above 140 degrees F will not be allowed, e.g., PVC or HDPE.

b. The minimum thickness for FRP jacket shall be as follows: For jacket diameter up to 15.5 inches - thickness =.055 inches; jacket diameter between 15.6 and 24.5 inches-thickness = .085 inches; jacket diameter between 24.6 and 31 inches-thickness =.110 inches; and jacket diameter between 31.1 and 40 inches-thickness = .140 inches.

c. All fittings of the insulated piping system shall be prefabricated to minimize field joints and jacketed in a chopped spray-up, polyester resin/fiberglass reinforcement composite, directly applied onto the insulating foam to a thickness related to the filament-wound jacket thickness.

11. Field Joints

a. The internal pipe shall be hydrostatically tested to 150 psig or 1-1/2 times the operating pressure, whichever is greater. Insulation shall then be poured in place into the field weld area. All field applied insulation shall be placed only in straight sections. Field insulation of fittings shall not be acceptable. The mold for the polyurethane shall be made of clear adhesive backed polyester film. The installer shall seal the field joint area with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory-applied resin. Backfilling shall not begin until the heat shrink wrap has cooled or until the FRP lay-up has cured. All insulation and coating materials for making the field joint shall be furnished by the piping system manufacture.

12. Backfill

a. A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the pipe. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6-inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil.

C. Above Grade Condenser Water Piping to be the same as above grade Chilled Water Piping.

1. Clean and paint all Condenser Water Piping.

D. Below Grade Condenser Water Piping to be the same as below grade Chilled Water Piping.

2.3 AIR/DIRT SEPARATORS

A. Furnish and install as shown on the drawings a coalescing type air eliminator and dirt separator on the hot and chilled water systems.

B. Units to be sized as scheduled on drawings.

C. Unit shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second at specified GPM.

D. Spirovent “HV” units specifically designed for high velocity systems may have an entering velocity of up to 10 feet per second.

E. Air Eliminators shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid.

F. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes.

G. Separator shall include a removable lower head to facilitate removal of internal assembly for inspection or cleaning.

H. Air/Dirt Separator to be Spirovent, Model HV or equal.

2.4 EXPANSION TANKS

A. Provide diaphragm type expansion tanks of size and number as indicated on drawings.

B. Tank to be made of welded steel and constructed, tested, and stamped in accordance with Section VIII of ASME Boiler and Pressure Vessel Code for working pressure of 125 psi. Furnish National Board Form U-1 denoting compliance. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting and drain fitting.

C. Acceptable Manufacturers:

1. Wessels
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.

2.5 CHEMICAL FEEDERS

A. Provide chemical feeders of 5-gallon capacity or otherwise as indicated

B. Chemical Feeder to be constructed of cast iron or steel, for introducing chemicals in closed hydronic system. Provide funnel and valve on top for loading, drain valve in bottom, and recirculating valves on side. Construct for pressure rating of 125 psi.

C. Acceptable Manufacturers:

1. Neptune Chemical Pump Company, Model DBF-5
2. Wingert Company, Model 5HD
3. Griswold
4. Or Equal

2.6 COOLING TOWER WATER TREATMENT

A. Furnish and install a Dolphin Clearwater Systems Corporation, or equal, chemical free water treatment device. Chemical treatment to have the following characteristics:

1. Provide with Transformer Panel.
2. Water treatment to be chemical free.
3. Water treatment device to have no moving parts and automatically eliminate scale and bio-debris building from clogging valves and heat exchanger channels.

PART 3 EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which hydronic piping systems and specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment, valves, etc. per manufacturer's written instructions and per industry standards.

C. Install piping in accordance with the ANSI Standard Code for Pressure Piping B31.1, latest issue.

D. Provide anchorage of piping, guides, and supports in accordance with SMACNA Guidelines.

E. Run piping straight and parallel with adjacent walls.

F. Piping located on roofs shall be mounted on curbs or other pipe supports to ensure that bottom of pipe elevation is a minimum of 12" above roof surface.

G. Ream pipes and tubes to full inside diameter. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

H. Connections:

1. Use full-cut standard taper pipe threads. Make up joints using Teflon® tape or nontoxic joint compound as related to the piping system involved. Apply to male threads only.
2. Use main-sized "Weld-O-Let" or "Thread-O-Let" branch connections or "Stub-in" in steel piping if main is at least one pipe size larger than the branch for up to 6 inches mains and if main is at least two pipe sizes larger than branch for 8 inches and larger mains. Do not project branch pipes inside the main pipe.
3. Make connections to equipment and branch mains with unions or flanges.
4. Provide dielectric unions wherever joining dissimilar metals in all systems and at equipment connections. Brass adapters and valves are acceptable. Do not mix dissimilar piping materials within subsystems of piping.

I. Route And Grades

1. Route piping in orderly manner and maintain proper grades. Coordinate and install to conserve headroom and interfere as little as possible with use of space.

Run exposed piping parallel to walls. Group piping whenever practical at common elevations. Install concealed pipes close to building structure to keep furring to a minimum.

2. Expansion, Contraction and Bending:
    a. Install piping with provisions for expansion and contraction.
    b. Provide expansion loops, swing joints, and/or expansion joints with pipe guides where indicated and otherwise required.
    c. Do not spring or force piping during installation.
3. Sloping, Air Venting and Draining:
    a. Slope piping as indicated, true to line and grade, and free of traps and air pockets.
    b. Unless indicated otherwise, slope piping in direction of flow as follows:
        1) Heating hot water to be sloped up at 1 inch per 40 feet.
        2) Chilled water to be sloped up at 1 inch per 40 feet.
4. Provide eccentric reducers as follows:
    a. Heating water and chilled water piping, top side flat.
    b. Between water piping and pump suction.
5. Provide concentric reducers as follows:
    a. In vertical piping.
    b. May be used as increasers in horizontal piping.
    c. Connect heating water and chilled water branch piping to bottom of main.
6. Provide drain valves and hose adapters at all low points in piping.
7. Provide drain valves for float type controllers.
8. Provide manual air vents at all high points in heating water, chilled water, and condenser water piping.

3.2 INTALLATION OF CHILLED WATER, HEATING WATER PIPING SYSTEM

A. Flush entire system with fresh water by circulation and periodically clean strainers. Continue flushing until strainers show no visible sediment, then drain system.

B. Circulate entire system with a detergent or other chemical and water solution to remove scale and rust for 8 hours. Drain and re-flush with clear water.

C. Pressure test with water at 1-1/2 times the working pressure, but not less than 150 psi, for 3 hours with no decay in pressure. Visually inspect joints for leaks, repair or replace, and retest.

D. Repair leaks which occur during the period of warranty, including any building damage or refinishing costs, at no cost to Owner.

E. Repair all defects which develop under tests promptly and repeat the tests. No caulking of screwed joints, cracks, or holes will be permitted.

F. Repair leaks in copper tubing by melting out the joint, thoroughly cleaning both parts, and re-soldering the joint.

G. Minor leaks in welded joints may be chipped out and rewelded. A general sweating of a welded joint may be cause for rejection of the entire joint.

H. Repair leaks in threaded pipe by replacing the thread or the fitting or both. Any replacement piece shall be the same length as the piece removed.

I. Underground Piping:

1. Factory trained field technical assistance shall be provided for critical periods of installation, including: unloading, field joint instruction, and testing.

2. Backfill pipe per manufacturer’s written instructions.

3.3 TEST OF PIPING

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of four hours at the test pressures indicated. Tests to be verified by Inspector of Record.

1. Test Chilled Water Systems with water at 150 psi at rough-in and at 100 psi after equipment connection.

2. Test Heating Hot Water Systems with water at 150 psi at rough-in and at 100 psi after equipment connection.

3. Test Condenser Hot Water Systems with water at 150 psi at rough-in and at 100 psi after equipment connection.

B. Testing equipment, materials, and labor shall be furnished by this **Contractor**.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.4 EQUIPMENT CONNECTIONS

A. Connect hydronic piping system to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return; drain valve on drain connection.

3.5 INSTALLATION OF HYDRONIC SPECIALTIES

A. Balance Valves: Install balance valves on each hydronic terminal and elsewhere as indicated. After hydronic system balancing has been completed, mark each balance

valve with stripe of yellow lacquer across body and stop plate to permanently mark final balanced position.

B. Vent Valves:

1. Manual Vent Valves: Install manual vent valves on each hydronic terminal at highest point and on each hydronic piping drop in direction of flow for mains, branches, runouts, and elsewhere as indicated.

2. Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain or as indicated.

C. In-Line Air Separators: Connect inlet and outlet piping.

D. Run piping to expansion tank with 1/4-inch per foot (2 percent) upward slope towards tank.

E. Install drain valve on units 2 inches and over.

F. Diaphragm-Type Expansion Tanks: Install diaphragm-type expansion tanks on floor as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system; charge tank with proper air charge as recommended by manufacturer.

G. Chemical Feeders: Install in upright position with top of funnel not more than 48 inches above floor. Install globe valve in pump discharge line between recirculating lines. Pipe drain to nearest plumbing drain or as indicated.

H. Water Relief Valves: Pipe discharge to floor drain or floor sink. Comply with ASME Boiler and Pressure Vessel Code.

I. Pressure-Reducing Valves: Install for each heat exchanger as indicated and in accordance with manufacturer's installation instructions.

3.6 INSTALLATION OF CHEMICAL TREATMENT SYSTEM

A. Comply with manufacturer's instructions for installation of chemical treatment system, except as otherwise indicated.

B. Piping shall be initially cleaned, before start-up of any equipment, with a suitable cleaning agent introduced into the piping system as recommended by the manufacturer. This treatment shall be circulated for not less than six hours, followed by flushing until neutral. Temporary circulating pumps shall be furnished by **Contractor**. Project pumps shall not be used for this purpose. Condenser water shall not be circulated until chemicals are introduced into the piping system.

C. Provide test equipment to test conductivity by portable solids meter, range 9-2500 ppm; nitrite by drop test; pH in range of 5.5 to 8.5 by color comparator; alkalinity by titration.

D. Secure the services of a water treatment specialist who will perform the following work:

1. Supervise initial cleanout of piping systems.
2. Supervise installation of chemical feed equipment to assure that all water treatment work is properly installed as specified.
3. Make water analysis and establish chemical and water balance to prevent corrosion and scale formation in the recirculating water.
4. Instruct the Owner's personnel in the use and control of the chemical treatments supplied.
5. After completion of work, submit recirculating water analysis and certification to Architect that all work has been performed in accordance with Drawings and specifications.

3.7 ADJUSTING AND CLEANING

A. Clean, flush, and inspect hydronic piping systems in accordance with requirements of Division-23 Basic Mechanical Materials and Methods sections.

3.8 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.9 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.10 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly

END OF SECTION 23 21 13

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SECTION 23 22 13

STEAM AND CONDENSATE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes steam and condensate piping and specialties for systems up to 125 psig, inside the building.

1.2 DEFINITIONS

A. HP Systems: High-pressure systems operating at 15 psig or more.

B. LP Systems: Low-pressure systems operating at less than 15 psig.

1.3 SYSTEM DESCRIPTION

A. Steam and condensate piping for this Project is a two-pipe, mechanical flow, up-feed system.

1.4 SUBMITTALS

A. Product Data: For each type of special-duty valve and steam trap indicated, including rated capacities and accessories.

B. Shop Drawings: Detail flash tank assemblies and fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, and expansion joints and loops and their attachment to the building structure. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For steam traps, vacuum breakers, and meters to include in maintenance manuals specified in Section 01830 Operation and Maintenance.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

C. Working Pressure: All high pressure steam valves, and fittings shall be rated for a minimum of 300 psi working pressure, including flanges, valves, strainers, and traps.

1.6 COORDINATION

A. Coordinate layout and installation of steam and condensate piping and suspension system components with other construction, including light fixtures, hydronic piping, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installation for foundation wall penetrations.

C. Coordinate pipe fitting pressure classes with products specified in related Sections.

D. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

E. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Section 078400 Firestopping for fire and smoke wall and floor assemblies.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Safety Valves:
   1. Spirax Sarco, Inc.

2. Kunkle Inds. Inc.; Kunkle Valve Division.
3. Watts Industries, Inc.; Watts Regulators.
4. Or equal.

B. Steam Traps (low-pressure):
1. ITT Hoffman; ITT Fluid Technology Corp.
2. Spirax Sarco, Inc.
3. Sterling, Inc.
4. Or equal.

C. Air Vents and Vacuum Breakers:
1. ITT Hoffman; ITT Fluid Technology Corp.
2. Johnson Corp. (The).
3. Spirax Sarco, Inc.
4. Or equal.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 piping application articles for applications of pipe and fitting materials.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: American Society for Testing and Materials (ASTM) A 53, Type S (seamless), Grade A, Schedules 40 and 80, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedules 40 and 80, black steel, plain ends.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300.

D. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 VALVES

A. Gate, globe, check, ball, and butterfly valves are specified in Section 15110 Valves.

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

2.5 SAFETY VALVES

A. Size and Capacity: As required for equipment according to the ASME Boiler and Pressure Vessel Code.

B. Bronze Safety Valves: Class 250, with threaded inlet and outlet; forged copper-alloy disc; fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

C. Cast-Iron Safety Valves: Class 250; forged copper-alloy disc with bronze nozzle; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff; raised-face flanged inlet and threaded outlet connections; factory set and sealed.
1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

D. Stop-Check Valves: Class 250, malleable-iron body and bonnet, cylindrical disc, removable liner and machined seat, brass-alloy stem, outside screw and yoke, polytetrafluoroethylene-impregnated packing with 2-piece packing gland assembly, flanged end connections, and cast-iron handwheel.

2.6 PRESSURE-REDUCING VALVES

A. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.

B. Valve Characteristics: Pilot air-actuated, diaphragm type, with adjustable pressure range and positive shutoff. Valves shall have cast-iron body with threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger; and hardened stainless-steel trim, replaceable head and seat, main head stem guide fitted with flushing and pressure-arresting device, cover over pilot diaphragm, and non-asbestos gaskets.

C. Manufacturer: Leslie Controls, Inc Model GPS, ITT Fluid Technology Corp., or equal.

2.7 STEAM TRAPS

A. High Pressure Steam Trap: float-and-thermostatic type, ASTM A842 Cast Iron body and bolted cap; renewable, stainless-steel float mechanism, 300-psig working pressure; TLV, J-series, cast iron, or equal, no known equal.

B. Low Pressure Steam Trap: float and thermostatic type, ASTM A 126, cast-iron body and bolted cap; renewable, stainless-steel float mechanism with renewable, hardened stainless-steel head and seat; maximum operating pressure of 125 psig; balanced-pressure, stainless-steel or monel thermostatic bellow element.
1. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.

2.8 THERMOSTATIC AIR VENTS

A. Quick Vents: Cast-iron or brass body, with balanced-pressure, stainless-steel or monel thermostatic bellows and stainless-steel heads and seats.

B. Float Vents: Cast-iron or brass body, seamless brass float, balanced-pressure thermostatic bellows, and replaceable stainless-steel seat, float, and head.

2.9 VACUUM BREAKERS

A. Vacuum Breakers: 150-psig steam working pressure, 365 deg F maximum operating temperature, brass or stainless-steel body, and stainless-steel retainer, spring, and ball; with plain or threaded outlet.

2.10 STRAINERS

A. Y-Pattern Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen, No. 20 mesh for NPS 2 and smaller and manufacturer's recommended perforations for NPS 2-1/2 and larger; tapped blow-off plug. Threaded connections for strainers NPS 2 and smaller and flanged connections for strainers NPS 2-1/2 and larger.

B. Basket Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen; bolted cover; threaded connections for strainers NPS 2 and smaller and flanged connections for strainers NPS 2-1/2 and larger.

PART 3 EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron fittings.

D. Condensate Piping, NPS 2-1/2 through NPS 12: Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

3.2 HP STEAM PIPING APPLICATIONS

A. Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 300 malleable-iron fittings.

B. Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 300 malleable-iron fittings.

D. Piping upstream of steam traps: Schedule 80 steel pipe, with threaded joints using Class 300 malleable-iron fittings.

3.3 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
   1. Shutoff Duty: Gate and ball valves.
   2. Throttling Duty: Globe and ball valves.

B. Install shutoff-duty valves at each branch connection to supply mains, at inlet connection to each steam trap, and elsewhere as indicated.

3.4 PIPING INSTALLATIONS

A. Refer to Section 15105 Pipes and Pipe Fittings for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install steam supply piping at a uniform grade of 0.2 percent downward in direction of steam flow.

E. Install condensate return piping at a uniform grade of 0.4 percent downward in direction of condensate flow.

F. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

G. Unless otherwise indicated, install branch connections to steam mains using 45-degree fittings in main pipe, with the takeoff coming out the top of the main pipe. Use of 90-degree tee fittings is permissible if 45-degree fittings are impractical. If length of branch takeoff is less than 10 feet, pitch branch line down toward mains at a 0.4 percent grade.

H. Install unions in piping NPS 2 and smaller adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated.

I. Install flanges in piping NPS 2-1/2 and larger at final connections of each piece of equipment and elsewhere as indicated.

J. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, traps, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

K. Anchor piping for proper direction of expansion and contraction.

L. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.
   1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet where pipe is pitched down in direction of steam flow and a maximum of 150 feet where pipe is pitched up in direction of steam flow.
   2. Size drip legs at vertical risers same size as pipe and extend beyond rise. Size drip legs at other locations same diameter as main. In steam mains NPS 6 and larger, dirt leg size can be reduced, but to no less than NPS 4.
   3. Install gate valve at drip legs, dirt pockets, and strainer blow-downs to allow removal of dirt and scale.
   4. Install steam traps close to drip legs.

M. Pitch condensate piping down toward flash tank. If more than one condensate pipe discharges into flash tank, install a swing check valve in each line. Install thermostatic air vent at top of tank. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the condensate load. Install safety valve at tank top. Install pressure gage, gate valve, and swing check valve on low-pressure (flash) steam outlet.

3.5 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment, but not more than 48 inches from connected equipment.
   1. Unless otherwise indicated, install gate valve, strainer, and union upstream from trap; install union, check valve, and gate valve downstream from trap.
   2. Provide Schedule 80 piping upstream of stream trap in accordance with drawing details.

3.6 PRESSURE-REDUCING VALVE INSTALLATION

A. Install pressure-reducing valves in readily accessible location for maintenance and inspection.

B. Install bypass piping around each pressure-reducing valve, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.

C. Install gate valves around each pressure-reducing valve.

D. Install unions around each pressure-reducing valve having threaded-end connections.

E. Install pressure gages on low-pressure side of each pressure-reducing valve and ahead of shutoff valve. Install pressure gages downstream from globe valve on pressure-reducing valve bypass.
   1. On two-stage pressure-reducing stations, install drip trap and pressure gage upstream from second stage pressure-reducing valve.

F. Install strainers upstream for each pressure-reducing valve.

G. Install safety valves downstream from each pressure-reducing valve station.

3.7 SAFETY VALVE INSTALLATIONS

A. Install safety valves according to ASME B31.1. Pipe safety valve discharge without valves to atmosphere outside building. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

3.8 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 230529 Supports and Anchors.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: Manufacturers Standardization Society of The Valve and Fittings Industry Inc. (MSS) SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.

C. Install hangers with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   4. NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
   5. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 1/2 inch.
   6. NPS 3: Maximum span, 15 feet; minimum rod size, 1/2 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.9 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install vacuum breaker downstream from control valve and bypass and close to coil inlet connection.

E. Install ports for pressure and temperature gages at coil inlet connections.

F. Install a drip leg at coil outlet.

3.10 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Flush system with clean water. Clean strainers.

3. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
4. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on steam and condensate piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drip legs installed at low points for complete draining of liquid.
3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
5. Prepare written report of testing.

3.11 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after steam and condensate system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:
1. Open valves to fully open position. Close coil bypass valves.
2. Set temperature controls so all coils are calling for full flow.
3. Check operation of automatic bypass valves.

3.12 CLEANING

A. Flush steam and condensate piping with clean water. Remove and clean or replace strainer screens.

END OF SECTION 23 22 13

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SECTION 26 05 00

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.

E. Provide connections of all equipment specified under this section and any other section and Division 22 and 23 including installation and connection of all relays, remote starters, etc. and the connection of all motors and controllers. Control wiring for Division 22 and 23 systems shall be provided by Division 23. Review Division 23 specifications and shop drawings for control systems to assure compatibility between equipment furnished under Division 26 and wiring furnished under Division 22 and 23. Motor controllers (starters) shall be furnished and installed under Division 26, unless specified to be furnished as an integral component of the equipment or unless controller is variable frequency drive type. Provide the number and type of auxiliary contacts necessary to interlock the equipment and provide the control sequence in Division 22 and 23.

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. 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.

D. 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.

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 be 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 23. 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.
   1. Make changes at no extra cost.

C. Do not change indicated sizes without written approval of University's Representative.

D. Provide all necessary offsets and crossovers in conduits, raceways, cabletrays and ducts.

E. 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.

F. Install exposed conduits parallel to walls and ceilings and vertically plumb, unless otherwise indicated.

G. 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.

H. Where electrical items penetrate fire or smoke rated walls, ceilings and floors, comply with Section Division 7.

I. 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.

J. Provide concrete foundations or pads as follows for floor mounted electrical equipment where indicated on the drawings:
   1. Install minimum 4” high concrete pads or as indicated. Other pad dimensions shall be as required to accommodate the equipment installed.
   2. Use 3,000 PSI (14 Kg/s/mm) concrete.
   3. Reinforce with 6” x 6” W2.9 x W2.9, 10GA (3.4mm) mesh, with short dowels into floor at 12” OC around perimeter.
   4. Chamfer top edges ¾” (18mm).
   5. Make all faces smooth.
   6. Set anchor bolts for equipment. Consult with user.
   7. Coordinate the size of all pads, the location of all anchor bolts, and the location of all vibration isolators.

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 suppliers 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. Where plywood backboards are used to mount electrical equipment provided under Division 26, paint backboards with two coats of light gray semi-gloss fire retardant paint under Division 26.

G. 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.

H. 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 indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.
2. Refer to the individual specification sections for test requirements.
3. 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.
4. All electrical systems shall be tested for compliance with the specifications.

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 TEMPORARY FACILITIES

A. Provide temporary shop office and storage space on site only at locations approved by the University's Representative. Remove these facilities upon completion of work.

3.14 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.

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SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

Part 1 - GENERAL

1.1 DESCRIPTION

A. The work required under this section of the specifications consists of furnishing, installing and connecting the building wiring system, 600 volts and below. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. Wiring systems for communication and alarm systems are not included in this section unless specified to be included, by reference, in the respective specification sections for alarm and communication systems.

1.2 RELATED WORK

A. Section 26 05 33 – Raceways

B. Section 26 05 20 – Electrical Connections for Equipment

1.3 QUALITY ASSURANCE

A. Industry Reference Standards. The following specifications and standards are incorporated into and become a part of this Specification by Reference.
   1. Underwriters' Laboratories, Inc. (UL) Publications:
      a. No. 83 Thermoplastic - Insulated Wires
      b. No. 486 Wire Connectors and Soldering Lugs
      c. No. 493 Thermoplastic - Insulated Underground Feeder and Branch Circuit Cables
   2. Insulated Cable Engineers Association Standards (ICEA):
      a. S-61-402 Thermoplastic Insulated Wire and Cable
   3. National Electrical Manufacturer's Standards (NEMA):
      a. WC-5 Thermoplastic Insulated Wire and Cable
      b. WC-26 Wire and Cable Packaging
   4. UBC Standard 4-1 for non-combustible materials for wires and cables above non-sprinklered ceilings.

B. Acceptable Manufacturers: Products produced by the following manufacturers which conform to this specification are acceptable.
   1. Hydraulically applied conductor terminations:
      a. Scotch (3M)
      b. Thomas and Betts (T&B)
      c. or equal
   2. Mechanically applied (crimp) conductor terminations:
      a. Scotch (3M)
      b. Thomas and Betts (T&B)
      c. or equal
   3. Vinyl electrical insulating tape:
      a. Scotch (3M)
      b. Tomic
      c. or equal
   4. Twist-On Wire Connectors:
      a. Buchanan
      b. Ideal
      c. or equal

5. Encapsulated insulating kits:
    a. Essex Group, Inc.
    b. Raychem
    c. Scotch (3M)
    d. or equal
6. Portable cable fittings:
    a. Crouse Hinds
    b. T & B
    c. or equal
7. Insulated cable:
    a. Pirelli Cable Corp.
    b. Southwire Co.
    c. or equal

C. Performance: Conductors shall be electrically continuous and free from short circuits or grounds. All open, shorted or grounded conductors and any other damaged insulation shall be removed and replaced with new material free from defects.

D. Delivery, Storage and Handling: Deliver wire and cable in accordance with NEMA WC-26. Wires and cables shall not be stored in an exterior or unprotected location. Material subject to direct exposure to the elements shall be replaced and removed from the project. Bring wire to job in original unbroken packages. Obtain approval of University's Representative before installation of wires.

1.4 SUBMITTALS

A. Submit shop drawings in accordance with the Conditions of the Contract and Division One Specifications Sections for the conductors, terminations, connectors, insulating tape, and insulating kits.

B. Submit field test reports indicating and interpreting test results required by the "Electrical Equipment Acceptance Testing" section of these specifications.

Part 2 - PRODUCTS

2.1 GENERAL MATERIALS REQUIREMENTS

A. Provide all materials under this section of the specifications.

B. All wire and cable shall be UL listed and shall bear a UL label along the conductor length at intervals not exceeding 24 inches.

C. All conductors shall have size, grade of insulation, voltage and manufacturer's name permanently marked on the outer cover at intervals not exceeding 24 inches.

D. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall not be less than indicated on the drawings. The minimum size of emergency systems conductors shall be No. 10 AWG.

E. Insulation voltage level rating shall be 600 volts.

F. All conduit and conductor sizes indicated on the drawings are based upon copper conductors. 60C ampacities shall be used for sizing of all wire and cable for branch circuits and feeders rated below 125 amps. 75C ampacities shall be used for sizing of all wire and cables for feeders rated 125 amps and above.

G. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.

2.2 PRODUCT/MATERIALS DESCRIPTION - CONDUCTORS

A. Conductors shall be stranded copper, 90°C, type THHN/THWN or XHHW unless otherwise indicated on the drawings, required by the California Electrical Code, or specified herein.

B. Fixture wire shall be No. 16 AWG silicone rubber insulated, stranded fixture wire, type SFF-2 (150°C), or No. 16 AWG thermoplastic, nylon jacketed stranded fixture wire, type TFFN (90°C). Color code as specified herein shall not be required for fixture wire; however, neutral conductor shall be identified distinctly from phase conductors. Conductors connected to vaportight fixtures shall be type AF.

C. Control conductors for use on 120 volt control wiring systems shall be No. 12 AWG stranded type THHN/THWN, where properly protected, unless indicated otherwise on the drawings. Switch legs are not considered control wiring.

D. Portable power cables and outlets shall be provided where indicated on the drawings. Cables shall be sized as indicated on the drawings with equal size green equipment ground. Cables shall be jacketed 600 volt SO type. Cable connectors shall be steel case liquid tight sized for cable diameter and shall use strain relief gland fitting to prevent tension on conductor terminals. Where cable drops are indicated on the drawings, use wire mesh strain relief cable grips at both ends of cable. Use cast type outlet device box for device cable drops.

E. Wire shall be 1991 Code type copper wire of not less than 98% conductivity. All wires shall be stranded. Wires shall bear the Underwriters' label, be color coded and be marked with gauge, type and manufacturer's name on 24" centers.

2.3 SPLICES, TAPS, AND CONNECTORS

A. Splices, taps and connectors (No. 10 AWG and smaller) - Splices and joints shall be twisted together electrically and mechanically strong and insulated with approved type insulated electrical spring connectors.

B. Splices, taps and connectors (No. 8 and larger) - Joints and connections shall be made with Burndy, T & B, or equal, solderless tool applied pressure lugs and connectors. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to 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. Feeder splicing, where permitted, shall be made with high compression sleeve type connector followed by manufactured splicing kit utilizing as insulators, resins poured into a ready-to-use plastic mold to provide a uniform, moisture-proof tough, impact-resistant insulation. Hydraulically applied crimping sleeve or tap connector sized for the conductor. Insulate the hydraulically applied connector with 90°C, 600 volt insulating cover provided by the connector manufacturer. Insulator materials and installation shall be approved for the specific application, location, voltage and temperature and shall not have an insulation value less than the conductor being joined.

C. 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.

Part 3 - EXECUTION

3.1 EXECUTION

A. Install all wiring in raceway system, except where conductors are indicated or specified not to be installed in raceway. Any conductors found to be damaged or defective, including insulation damaged during installation, shall be removed and replaced at no expense to the University.
   1. Pull conductors into raceway simultaneously where more than one is being installed in the same raceway.
   2. Use UL listed pulling compound or lubricant where necessary to reduce cable pulling tension below the manufacturer's recommended levels. Compound used shall not deteriorate conductor or insulation.
   3. Use pulling means, including fish tape, cable rope, or basket-weave wire/cable grips that will not damage cable or raceway.

B. Connect all conductors. Torque each terminal connection to the manufacturers recommended torque value. A calibrated torquing tool shall be used to insure proper torque application.

C. Do not install more conductors in a raceway than indicated on the drawings. A maximum of three branch circuits are to be installed in any one conduit, on 3 phase 4 wire system, unless specifically indicated otherwise on the drawings. No two branch circuits of the same phase are to be installed in the same conduit, unless specifically indicated on the drawings.

D. Conductors shall be tested to be continuous and free of short circuits and grounds.

E. Maintain phase rotation established at service equipment throughout entire project.

F. Group and lace with waxed linen lacing cord (T & B "Ty-Rap", Holub "Quik-Wrap" or equal) all conductors within all enclosures, i.e., panels, motor controllers, equipment cabinets, switchboards, etc.

G. 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. Do not splice conductors in pull boxes, panelboards, safety switches, switchboard, switchgear, motor control center, or motor control enclosures.

H. Splices in conductors installed below grades are not permitted, unless approved in writing by the University's Representative. For taps indicated on the drawings and approved splices below grades, connections shall be made in flush mounted watertight junction box with crimp connectors and watertight resin encapsulating insulating kit. Service entrance conductors shall not be spliced.

I. Support conductors installed in vertical raceways at intervals not exceeding those distances indicated in the California Electrical Code. Support conductors in pull boxes with bakelite wedge type supports or "Kellem" grips or equal, provided for the size and number of conductors in the raceway. Do not splice conductors in pull boxes used for vertical cable supports unless written permission for splicing is obtained. Where splicing is permitted, make splice with hydraulically applied splicing sleeve.

J. Terminate conductors No. 10 AWG and smaller specified in Division 26 to be stranded, with crimp type lug or stud. Direct termination of stranded conductors without crimp terminator to terminal screws, lugs, or other points is not permitted even if terminal is rated for stranded conductors. Crimp terminal shall be the configuration type suitable for terminal point.

K. Make connections between fixture junction box and fixture with fixture wire.

L. Control, communications or signal conductors shall be installed in separate raceway systems from branch circuit or feeder raceway, unless indicated otherwise on the drawings.

M. Conductor lengths for parallel circuits shall be equal. Do not configure isolated phasing in separate conduits for parallel conductors.

N. Install a minimum of twelve inches (300 mm) of slack conductor at each outlet.

O. Thoroughly clean conductors prior to installing lugs and connectors.

3.2 IDENTIFICATION

A. Color Code Conductors:
   1. Color code all secondary service, feeder and branch circuit conductors. Control and signal system conductors need not be color coded.
   2. Coding shall be as follows:
      a. 208Y/120 volt three phase four wire wye system - Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White, Travellers: Orange.
      b. 480Y/277 volt three phase four wire system - Phase A: Brown, Phase B: Violet, Phase C: Yellow, Neutral: Gray, Travellers: Pink.
      c. Grounding conductors shall be green. Grounding conductors for isolated ground circuits shall be green with a yellow trace.
   3. Phase conductors No. 10 and smaller shall have solid color compound insulation or color coating. Phase conductors No. 8 and larger shall have solid color compound, color coating or colored phase tape. Colored tape shall be installed on conductors in every box, at each terminal point, cabinet, through manhole or other enclosure.

B. Conductors within pull boxes shall be grouped and identified with nylon tie straps with circuit identification tag.

C. Identify each control conductor at its terminal points with wrap around tape wire markers. I.D. to indicate terminal block and point designation, or other appropriate identifying indication.

D. Refer to ELECTRICAL IDENTIFICATION section of these specifications for additional identification requirements.

3.3 TESTING

A. Refer to Electrical Equipment Acceptance Testing section of this specification for testing requirements.

END OF SECTION

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SECTION 26 05 20
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electrical Connections to equipment specified under other sections or as shown on drawings.

1.02 SUBMITTALS

A. None Required.

1.03 REFERENCE STANDARDS.

A. Underwriters Laboratories.

B. NEMA WD5 – Specific Purpose Wiring Devices.

1.04 QUALITY ASSURANCE

A. Field verify equipment rating with manufacturers nameplate data. Adjust feeders and overcurrent protectors as required to comply with code requirements.

PART II - PRODUCTS

2.01 LUGS

A. Acceptable Manufacturers.

1. Burndy Corporation.

2. ILSCO Corp.

3. Or Equal

B. Compression Type: Seamless, one piece, copper, size per conductor applied to, two NEMA Drill.

C. Set Screw Type: Pin type compression fittings for use on #2 AWG and larger conductor sizes, barrels filled with conductive paste.

2.02 CRIMP ON TERMINALS

A. Acceptable Manufacturers

1. Thomas-Betts

2. 3M

3. Or Equal

B. Crimp on, insulated terminals for use on #14 AWG thru #10 AWG conductor size, flanged fork or ring torque style.

2.03 CONNECTORS, SPLICES AND TAPS

A. Acceptable Manufacturers

1. Burndy

2. ILSCO

3. Or Equal

B. Compression or set screw type with insulating cover for use on #8 AWG and larger conductor.

C. Split bolt connectors with insulating covers for use on #6 AWG and larger conductor.

2.04 WIRE CONNECTORS

A. Acceptable Manufacturers

1. Ideal Industries

2. Buchanan

3. Or Equal

B. Conical spring type with nylon or plastic outer shell, color coded to denote wire size, for use on #14 AWG thru #10 AWG conductors.

C. Butt Compression style insulating crimp splices for use on #14 AWG and smaller conductors.

PART III - EXECUTION

3.01 INSTALLATION

A. Bus Connection: Use compression lugs, bolt to bus bars using cap screws, lock washers and nuts of material electrically compatible with bus.

B. Set Screw Connection: Install pin type compression fitting of similar construction as compression lugs.

C. Terminations to Motors: Use crimp on connectors for motor terminations from stranded conductors and where terminal lugs are not provided by equipment supplier. Use ring-tongue terminals where ever possible.

D. Use connector manufacturer approved crimping tool to install connectors. Do not remove conducting strands or oversize connector. Apply insulating tape over exposed conductor to 150% of conductor insulating material.

E. Tighten connections to ensure maximum surface contact between terminals.

F. Strip insulation per manufacturers instructions, use conductive paste where required.

G. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices.

H. Coordinate with other work, including wires, cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

I. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

J. Fasten identification markers to each electrical power supply conductor which indicates their voltage, phase and feeder number in accordance with Electrical Identification section. Affix markers on each terminal conductor, as close as possible to the point of connection.

3.02 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed. Do not proceed with the work until conditions are acceptable for terminations.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installing of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirements. Correct malfunctioning units at site, then retest to demonstrate compliance.

B. Test all wiring and connections for continuity and grounds; where such test indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.

C. Provide documentation of all tests as specified by this and other sections in the following formats. Submit in an electronic form (2 copies) and in hard paper form (2 copies). Submit interim test reports to the University’s Representative and ‘final’ acceptance test reports (where only one test iteration is required consider it be the ‘final’) to the prime electrical contractor (for a single, consolidated submission of all electrical test and O&M’s to the University). Compile the electronic copies (including graphics or drawings) entirely in the current version of Acrobat Abode complete with an interactive field linked Table of Contents (linked to the chapters and subsections within the report). Submit electronic copies on a CD (or CD's).

D. All electrical systems testing (power and low voltage) as described by each central collection point for all test documentation, whether the tested systems were provided and installed under his contract or not. All Division 16 contractors and vendors are required to cooperate with the prime electrical contractor in this regard and the single submission of tested results shall be considered a contract requirement of all contractors and vendors for all electrical, communication, data, etc. work performed under Division 16.

E. Provide a copy of the test documentation with the O&M Manual submission.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electrical Equipment and Raceway Grounding and bonding.

1.02 SUBMITTALS

A. Submit a complete set of marked-up record drawings to indicate installed location of system grounding electrode connections, and routing of grounding electrode conductor.

B. Submit certified test results stating ground resistance from service neutral at service entrance.

1.03 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA).

B. American National Standards Institute (ANSI).

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Erico

B. Oz Gedney.

C. or equal

2.02 MATERIALS

A. Ground Clamp: Water pipe connection, bronze two-piece with serrated jaws, lug sized for grounding electrode conductor.

B. Connectors, Compression Type: Bronze or Copper, pretreated with conductive paste, sized for conductor to which applied.

C. Connectors, Exothermic Weld Type: Powder actuated weld. Bond made through exothermic reaction producing molten copper from premixed copper oxide and aluminum powder. Form bond in mold or crucible.

2.03 SECONDARY GROUNDING SYSTEM

A. Except where specifically indicated otherwise, all exposed noncurrent carrying metallic parts of electrical equipment, metallic raceways systems, grounding conductor in nonmetallic raceways and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment of each service and shall be extended to all required components of CEC Article 250.

2.04 GENERAL BRANCH CIRCUITS GROUNDING

A. All grounding conductor wire shall be insulated green copper conductors.

B. All conduit bushings shall be grounding type.

C. All grounding connections shall be made with solderless lugs and nonferrous hardware.

PART III - EXECUTION

3.01 GENERAL BRANCH CIRCUITS AND FEEDERS

A. All conduit systems, equipment housings, material housings, junction boxes, cabinets, motors, ducts, wireways, cable trays, light fixtures, portable equipment and all other conductive surfaces shall be solidly grounded in accordance with the California Electrical Code to form a continuous, permanent and effective grounding system.

B. Install a separate green grounding conductor in all conduits, including feeder, branch circuit, and flexible; both metallic and non-metallic. The conduit systems shall not be relied upon as the system equipment grounds. Size all grounding conductors per CEC 250 unless a larger ground is indicated on the drawings. Secure grounding conductors using approved methods to each pull box, junction box, and equipment housing.

C. All panelboards, junction boxes, pullboxes, wireways and equipment enclosures shall be bonded to the conduit systems.

D. All building expansion joints shall be bonded.

E. Isolated ground receptacles shall have both an isolated ground conductor and a separate equipment grounding conductor.

3.02 MOTOR CIRCUITS

A. All motor circuits shall have a ground wire pulled with the phase conductors. The ground wire shall be extended from the panel ground bus and shall be bonded at all junction boxes, pullboxes, disconnect switches, controllers, motor connection boxes, and motor frames. Each motor with a Variable Frequency Drive controller shall have a dedicated grounding conductor. Ground these motors back through the VFD controller as recommended by the drive manufacturer to eliminate radio frequency interference. Also, the wiring between the VFD controller and the motor shall be in a dedicated conduit.

3.03 FLEXIBLE RACEWAY GROUNDING

A. Install a ground conductor inside all flexible raceways (e.g. flexible steel, liquid tight). Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated or required by code, whichever is larger.

3.04 SECTIONAL RACEWAY

A. Install a ground conductor in all sectional raceways with removable covers for access (e.g., plug-in strips, surface raceways systems, and wireways). Size conductor in accordance with the CEC for the largest phase conductor size installed in raceway, or as indicated. Bond all sections of the raceway to the ground conductor. Connect all receptacle ground terminals in the raceway to the ground conductor, and make other

ground connections indicated. This also includes all sectional raceways installed in or on University provided furniture. All surface metal raceways shall be UL listed as an equipment grounding conductor.

3.05 GENERAL GROUNDING REQUIREMENTS

A. All ground connectors shall be bronze of the clamp type. All clamp accessories such as bolts, nuts, and washers shall also bronze to assure a permanent corrosion-resistant assembly. Connector shall be as manufactured by Burndy Engineering Company, Ilsco Corporation, or equal. Make connections easily accessible for inspection, underground or concealed in floors or walls.

B. All ground cable splices, joints, and connections to ground rods shall be made with an exothermic welding process which shall provide a weld with current-carrying capacity not less than that of the conductors welded. Soldered connections shall not be used.

C. All ground wire shall be insulated, unless otherwise indicated on the Drawings, extra flexible stranded copper cables. Grounding cables installed in earth shall be laid slack.

D. Lighting and power panelboards shall be grounded by connecting a grounding conductor to the grounding stud and to the incoming and outgoing feeder conduits grounding bushings. Each grounding-type bushing shall have the maximum ground wire accommodation available in standard manufacturer for the particular conduit size. Connection to the bushing shall be with wire of this maximum size.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Conduit and equipment supports.

2. Fastening hardware.

3. Vibration Isolation.

1.02 SUBMITTALS

A. Submit for each isolator, complete manufacturer's description including quantity loading and static deflection.

1.03 REFERENCE STANDARDS

A. American Plywood Association. (APA)

B. Underwriters Laboratories. (UL) "Building Materials Directory".

1.04 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART II - PRODUCTS

2.01 SUPPORT CHANNELS

A. Acceptable Manufacturers – Support Channels

1. Unistrut

2. Super Strut

3. Or Equal

B. Support Channel: 12-gauge galvanized or painted steel, "U" section, 1-½" square nominal in section.

C. Hardware: Manufacturer's standard as required to support equipment. Provide corrosion resistant finish.

2.02 CONDUIT SUPPORTS

A. Conduit clamps, straps, and supports shall be steel or malleable iron for all exposed individual conduit runs. Clip type hangers may be used in concealed areas on individual

conduit runs. Group mounted, exposed or concealed shall be supported by trapeze hangers constructed of formed steel channels and threaded rods.

2.03 VIBRATION ISOLATION

A. Provide vibration isolation in all supporting hardware for vibrating electrical equipment, (e.g., transformers). Isolators shall be as recommended by manufacturer to maximize their effect. Isolators shall be as manufactured by Mason Industries, or equal.

PART III - EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using bolts, beam clamps, and spring steel clips.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to piping, ductwork, mechanical equipment, other conduit, or roof deck.

D. Install all support devices according to manufacturers guidelines and recommendations.

E. Do not drill through structural framing members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

G. Install freestanding electrical equipment on concrete pads four inches high and overlapping equipment footprint by two inches on all sides.

H. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls with #10 S.M.S. at 12" o.c., 4 minimum, typical unless otherwise noted.

I. Do not exceed a maximum point load of 100 lbs. to any member. Locate point loads at least 4’ from any other point load on the same member.

J. All equipment shall be installed in full compliance with all applicable seismic requirements of Title 24, Part 2, CBC.

END OF SECTION

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SECTION 26 05 32
PULL BOXES AND JUNCTION BOXES

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior Pull and Junction Boxes

1.02 SUBMITTALS

A. Required.

1.03 REFERENCES

A. Underwriters Laboratories (UL)

B. National Electrical Manufacturers Association (NEMA) #250 - Enclosures for Electrical Equipment (1000 volts maximum).

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. O.Z. Gedney; General Signal

B. Hoffman

C. Or Equal

2.02 PULLBOXES 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. The boxes shall have a flat removable, galvanized sheet metal cover held in place with binder head sheet metal screws. Supply boxes with no knockouts.

B. Size boxes by code requirements related to the number and size of conduits and wire entering the box.

C. Standard size metal boxes stamped from galvanized steel shall be used for indoor general purpose where size and capacity are acceptable by code.

D. Boxes shall be of the depth required for wiring capacity. Boxes shall be cast iron with threaded hubs for vaportight and wet locations.

E. Boxes for hazardous (classified) locations shall be approved for the classification and use.

F. Provide boxes with a blank cover.

PART III - EXECUTION

3.01 INSTALLATION

A. Pull boxes and junction boxes required are not shown on the plans; however, they shall be provided to meet Code requirements and improve ease of wire pulling. Provide pull boxes or junction boxes in conduit runs over 90' long or when more than 4 quarter bends occur in a conduit run. Boxes shall be sized to meet CEC requirements.

B. Mount all pullboxes and junction boxes securely to the building structure. Boxes shall not depend on conduit for support.

C. Install pullboxes and junction boxes such that covers are accessible. Do not install in finished areas unless approved by University's Representative.

D. Cut or sheared edges shall be filed or honed, eliminating all sharp edges.

E. Pullboxes and junction boxes shall be installed with unused or open knockouts plugged.

F. All junction boxes shall be labeled on cover indicating circuit number and panel number and all wires shall be labeled in junction boxes with circuit numbers.

END OF SECTION

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SECTION 26 05 33
RACEWAYS

PART I - GENERAL

1.01 DESCRIPTION

A. This section covers the complete interior raceway system.

B. Definition: The term conduit, as used in this Specification, shall mean any or all of the raceway types specified.

1.02 SUBMITTALS

A. Required.

1.03 QUALITY ASSURANCE

A. Referenced Industry Standard: The following specifications and standards are incorporated into and become a part of this Specification by reference.

1. Underwriters' Laboratories, Inc. (UL) Publications:

a. No. 1 Flexible Metal Electrical Conduit

b. No. 1242 Rigid Galvanized Conduit

c. No. 467 Electrical Grounding and Bonding

d. No. 797 Electrical Metallic Tubing

e. No. 1242 Intermediate Metal Conduit

2. American National Standards Institute (ANSI):

a. C-80.1 Rigid Galvanized Conduit

b. C-80.3 Electrical Metallic Tubing

B. Acceptable Manufacturers: Products of the following manufacturers, which comply with these specifications, are acceptable.

1. Metallic Conduit Fittings:

a. RACO

b. Thomas and Betts

c. or equal

2. Support Channel:

a. Powers

b. Unistrut

c. or equal

C. Coordination

1. Coordinate conduit installation with electrical equipment furnished.

2. Coordinate conduit installation with contract documents. Adjust installation to eliminate conflicts. Review all shop drawings submitted under this and other sections to insure coordination with all equipment requiring electrical service and to avoid conflict interferences. Coordinate installation sequence to avoid conflicts including equipment access and provide the fastest overall installation schedule.

1.04 STORAGE AND HANDLING

A. Refer to the Basic Electrical Requirements section of the specifications for storage and handling requirements.

B. Damaged, oxidized, warped, improperly stored material or material with excessive amounts of foreign debris will be removed from the project and replaced with new materials, at no cost to the University.

PART II - PRODUCTS

2.01 GENERAL MATERIALS REQUIREMENTS

A. Furnish all materials specified herein.

B. All conduit and fittings shall be listed and bear a label by Underwriters' Laboratories (UL) for use as raceway system for electrical conductors.

C. Raceway is required for all wiring, unless specifically indicated or specified otherwise.

D. Size: The minimum size of conduit shall be ¾". The size of all conduits shall be in accordance with the CEC using 30% fill, but not less than indicated on the drawings.

E. Bushings shall be metallic insulated type. Weatherproof or dust-tight installations shall be liquid-tight with sealing ring and insulated throat. Bushing shall be OZ/Gedney type KR, or equal (Or equal, no known equal.)

F. Expansion and deflection fittings shall be OZ/Gedney, type DX, or equal

2.02 EMT CONDUIT AND FITTINGS

A. Electrical Metallic Tubing shall conform to UL 797, cold rolled steel tubing with zinc coating on outside and protective enamel coating on inside.

B. Electrical Metallic Tubing (EMT) couplings and connectors shall be steel compression "concretetight" type. Malleable iron, die cast or pressure cast fittings are not permitted. All connectors shall be nylon insulated throat type. Fittings shall meet same requirements

for finish and material as EMT conduit. Box connectors shall be equipped with insulated throat.

C. Connectors at cabinets, boxes, and gutters shall be metallic nylon grounding type with insulated bushings.

2.03 RIGID AND IMC CONDUIT and FITTINGS

A. Intermediate metallic conduit and rigid steel conduit shall conform to UL 6, standard weight, mild steel pipe, zinc coated on both inside and outside by a hot dipping or sherardizing process. Inside and outside of conduit shall be finished with a protective coating.

B. Fittings for rigid steel and IMC shall be standard threaded couplings, locknuts, bushings and elbows. Fittings shall be assembled with anti-corrosion, conductive anti-seize compound at joints made absolutely tight to exclude water. All materials shall be steel or malleable iron only. Setscrew or non-thread fittings are not permitted.

C. Bushings shall be metallic insulating type consisting of insulating insert molded or locked into the metallic body of the fittings.

D. Erickson-type couplings may be used to complete a conduit run. IMC couplings may be the integral retractable (Uni-Couple) type.

E. Connectors at cabinets, boxes, and gutters shall be metallic nylon grounding type with insulated bushings.

2.04 CONDUIT SUPPORTS

A. All parts and hardware shall be zinc-coated or have equivalent corrosion protection.

B. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

C. Conduit support channels shall be 1.5" x 1.5" x 14 gauge galvanized (or with equivalent treatment) channel. Channel suspension shall be minimum ¼" threaded steel rods. Spring steel clips are not acceptable. Conduit straps shall be spring steel conduit straps compatible with channel. Wire or chain is not acceptable for conduit hangers. All installations shall meet applicable seismic requirements.

D. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose, sized appropriately for the conduit type and diameter, and have pre-assembled closure bolt and nut and provisions for receiving threaded hanger rod. Support with ¼" threaded steel rod for individual conduits 1.5" and smaller and ⅜" rod for individual conduits 2.0" and larger. All installations shall meet applicable seismic requirements.

E. Individual conduit straps on metal studs shall be spring steel and should wrap around entire face of stud securely biting into both edges and have provisions for screwing into stud. Size for conduit to be support. Tie wraps are not acceptable.

F. Support multiple conduits from metal studs using pre-assembled bar hanger assembly consisting of hanger bar, retaining clips and conduit straps.

2.05 FLEXIBLE CONDUIT AND FITTINGS

A. Flexible conduit shall be steel metallic type, zinc coated on both inside and outside by hot dipping or sherardizing process.

B. Where specified herein, indicated on the drawings, or when used in damp or wet locations, as classified by the California Electrical Code, flexible conduit shall be liquid tight. Liquid-tight conduit shall be galvanized with extruded polyvinyl covering and with water-tight connectors.

C. All flexible conduit shall be classified as suitable for system grounding.

D. Connectors for flexible conduit shall be steel insulated throat type rated as suitable for system ground continuity. Connectors for liquid tight flexible conduit shall be screw-in ground cone type.

E. Flexible conduit shall not be less than ¾" trade size and in no case shall flexible conduit size be less than permitted by the California Electrical Code for the number and size of conductors to be installed herein.

F. No aluminum flexible conduit shall be used.

2.06 MISCELLANEOUS CONDUIT FITTINGS AND ACCESSORIES

A. Vinyl all weather electrical tape for corrosion protection shall be Scotch #88, Tomic #85, Permacel #295 or equal.

B. Expansion and deflection couplings shall be in accordance with UL 467 and UL 514. They shall accommodate ¾" deflection, expansion, or contraction in any direction and shall allow 30º angular deflections. Couplings shall contain an internal flexible metal braid to maintain raceway system ground continuity.

C. Fire and smoke stop materials shall be UL rated to maintain the fire floor or firewall partition rating.

PART III - EXECUTION

3.01 INSTALLATION

A. General

1. Conceal all conduits, except in unfinished spaces such as equipment rooms or where indicated by symbol on the drawings or as approved by the University's Representative. Run concealed in areas having finished ceilings and furred walls. Run all cross conduits and vertical risers or drops concealed in wall and/or partitions. Run vertical risers or drops up or down between wall studs. Should it be necessary to notch any framing members, notch only at locations in a location and manner approved by University's Representative.

2. Exposed conduit below 8'-0" shall be rigid type.

3. Provide flexible connections of short length to equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor in all flexible connections.

4. Support conduits per seismic guidelines outlined in section 16012.

5. Maintain a minimum of 6" clearance from conduit to steam or hot water pipes.

6. Leave all empty conduits with a galvanized pull wire or nylon pull rope.

7. Install as complete raceway runs prior to installation of cables or wires.

8. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

9. Secure rigid conduit i.e., rigid galvanized conduit and intermediate metal conduit, to sheet metal enclosures with two (2) locknuts and insulated bushing. Secure EMT to sheet metal enclosures with insulated throat connectors.

10. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel. Nails are not acceptable.

11. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until all masonry is complete. Protect conduit stud-ups during construction from damage; any damaged conduits shall not be used.

12. Install conduit with wiring, including homeruns as indicated on the drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by University's Representative by written authorization.

13. Where conduit passes through finished walls or ceilings, provide steel escutcheon chrome plates or paint as directed.

14. Provide sleeves for conduit passing through floor slabs and/or concrete masonry walls.

15. Separate raceway systems are to be installed for power systems and for control, signal and communications systems. Do not install control, signal or communications cables in the same raceways as branch circuit or feeder cables, unless indicated otherwise on the drawings.

16. Provide expansion fitting in all conduits where length of run exceeds 200’ or where conduits pass building expansion joints.

B. Uses Permitted

1. Galvanized rigid conduit shall be used as follows:

   a. All exposed outdoor locations.

   b. In damp or wet locations including outdoor service yards and roofs, in concrete walls or block walls, and in concrete vaults.

   c. 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.

d. In poured concrete walls or block walls, in concrete vaults, floor and roof construction, provided a minimum of 2" of cover is maintained.

e. In all walls up to the first outlet box where fed from rigid conduit in damp locations or locations exposed to the weather.

f. In exposed interior locations below 8’ above the floor, including all mechanical rooms.

g. All elbows for underground plastic conduit.

h. All conduits for interior wiring systems whose voltage is above 600 volts.

i. All conduits entering refrigerated spaces.

j. Elsewhere where indicated on the drawings.

k. For emergency branch feeders and circuits installed outside of building.

2. Electrical metallic tubing (EMT) shall be used as follows:

a. Concealed in stud partitions and hollow masonry walls.

b. For connections from junction box to lighting fixtures except in accessible ceilings.

c. Above In suspended or accessible ceilings above 8’.

d. Exposed in dry locations above 8 feet where not subjected to mechanical damage.

e. In furred ceiling spaces.

f. For fire alarms system conduit. Paint red 6" wide every eight feet.

3. 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).

4. Conduit types shall not be mixed indiscriminately with other types in the same run, unless specified herein or required by the CEC.

5. Use flexible conduit for connections to motors, dry type transformers, electrical duct heaters, unit heaters, expansion joints, and flush mounted lighting fixtures. Conduit must be secured.

a. Flexible conduit used for connection of motor, dry type transformers, electric duct heaters, and unit heaters, shall not exceed 18" in length.

b. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.

c. 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.

6. 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.

7. Where hazardous locations, as classified by the California Electrical Code, exist, all conduits and fittings and the installation of these materials shall comply with Article 500 of the California Electrical Code.

8. LB condulets for conduits larger than 1-½" I.D. shall not be used unless of the mogul design and secured to the building structure within 6" below and along the side of the condulet.

C. Concealed (Above Ceilings and in Walls) and Exposed Raceway Installation

1. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members.

2. Support branch circuit conduits at intervals not exceeding 10’ and within 3’ of each outlet, junction box, cabinet or fitting. Attach individual branch circuit conduits to structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hangar rod and conduit clamp assembly. Multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

3. Attach feeder conduits larger than 1" trade diameter to or from structure on intervals not exceeding 10’ with conduit beam clamps, one hole conduit straps or trapeze type support in accordance with support systems described for branch circuit conduits.

4. Single-flange clamps are unacceptable

5. Exposed conduits shall be painted, see Section 09900 of the specifications.

6. For fire alarms system conduit. Paint red 6" wide every eight feet.

7. Install conduit sleeves in slabs where conduits 2.0" and larger pass through. Sleeves shall extent 1" minimum above finished slab. Seal all spare sleeves and between conduits and sleeves to maintain fire rating and to make watertight and smoketight.

8. Install all conduits or sleeves penetrating rated firewalls or fire floors to maintain fire rating of wall or floor.

9. Conduits rigidly secured to building construction on opposite sides of a building expansion joint shall be provided with an expansion and deflection coupling. In lieu of an expansion coupling, conduits 2-½" and smaller may be provided with junction boxes on both sides of the expansion joint connected by 15" of slack flexible conduit with bonding jumper.

3.02 ADJUSTMENT, CLEANING AND PROTECTION

A. Clean: Upon completion, clean all installed materials of paint, dirt, and construction debris. All conduit systems shall be cleaned of water and debris prior to the installation of any conductors.

END OF SECTION

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SECTION 260535
ELECTRICAL BOXES AND FITTINGS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pressed Steel Boxes and Fittings.

1.02 SUBMITTALS

A. Required.

1.03 REFERENCE STANDARDS

A. Underwriters Laboratories (UL).

B. National Electrical Manufacturers Association (NEMA) #250 - Enclosures for Electrical Equipment.

C. NEMA 051 - Sheet steel outlet boxes, device boxes, covers and box supports.

PART II - PRODUCTS

2.01 STEEL BOXES AND FITTINGS

A. Acceptable Manufacturers:

1. Midwest Electric

2. RACO

3. or equal

B. Boxes to be non-gangable, having knockouts as required and compatible covers or extension rings suitable for installed devices.

C. Boxes to be galvanized stamped steel, with grounding lug tapped hole.

D. Provide ⅜" fixture studs in ceiling outlet boxes where required.

PART III - EXECUTION

3.01 GENERAL

A. Install all boxes so they are completely covered by the wall plate or fixture.

B. Provide galvanized one-piece or welded pressed steel boxes and fittings unless indicated otherwise. Provide galvanized steel outlet box covers for surface mounted galvanized steel boxes in unfinished areas. Boxes in unfinished areas, installed exposed, shall be cast type "conduit" for switches and convenience outlets. Exposed boxes mounted below

8' from finished floor shall be cast type. Provide blank cover for all boxes without fixture or device.

C. Install all outlet boxes rigidly, plumb, and level. Secure outlet boxes to ceiling system support members and wires using only clips designed and approved for the purpose. Do not cut insulation in outside walls to install outlet boxes. Do not use through-the-wall boxes unless specifically noted. Do not install boxes back-to-back in adjoining rooms. Offset outlet boxes installed back-to-back in fire-rated walls and partitions a minimum of 24 inches horizontally. Protect boxes during construction to prevent entrance of foreign materials such as concrete, mortar, plaster, paint, etc.

D. Flush mounted boxes shall be installed with opening edge flush with finish surface.

E. Pull boxes shall be provided in all runs of 90' or more in length or such that not more than four 90° bends occur between boxes. Junction and pull boxes shall be located in accessible locations and shall be concealed in finished work and shall be permanently identified with system label. Where concealed accessible space is not available in finished areas, boxes shall be flush mounted with rings and blank plates at standard boxes, flanges and plaster stops at large boxes. Flush boxes shall be carefully aligned to be plumb. Locations to be coordinated with University's Representative prior to installation.

F. 4" octagonal boxes or square boxes with plaster rings shall be used for ceiling or wall light fixture outlets. Boxes for fixtures shall be equipped with fixture studs. Boxes shall be supported as required to carry loads as required by code. Other ceiling outlets shall be 4" square or larger with plaster rings unless indicated otherwise on drawings. Boxes shall be flush mounted or concealed in finished construction.

G. Provide minimum of ¾" plaster rings designed for the purpose for outlet boxes in plaster or gypsum board walls.

H. Provide masonry boxes and extension rings for boxes in concrete block, brick, and glazed tile walls. Secure with auxiliary plates, bars or clips and grout in place.

I. Install outlet device mounting rings such that they extend no more than $^{1}/_{16}$", or are recessed no more than $^{3}/_{16}$" from wall surface.

J. Support all outlet boxes independently from the raceway systems. Securely support by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rest inhibitor.

K. For dimensional locations of the actual installed location shall not vary from the dimensioned location by more than plus or minus one-half inch, unless otherwise noted.

L. Boxes for local switches shall be at least 1-½" deep 4" square for 1 or 2 gang switches, with switch plaster rings and gang box with gang cover.

M. Boxes for telephone and data shall be minimum 2-⅛" deep.

N. Use screws and not nails to support outlet boxes.

O. Nails shall not be used to support outlet boxes. Boxes must be accurately placed for finish, independently and securely supported by adequate wood backing or by

manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry, tile, or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 DESCRIPTION

A. Extent of electrical identification work is as outlined by this specification.

B. Types of electrical identification work specified in this section include the following:

1. Electrical power, control and communication conductors.

2. Operational instructions and warnings.

3. Danger signs.

4. Equipment/system identification signs.

1.02 QUALITY ASSURANCE

A. CEC Compliance: Comply with CEC as applicable to installation of identifying labels and markers for wiring and equipment.

B. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

C. ANSI Compliance: Comply with applicable requirements of ANSI Std A13.1, "Scheme for the Identification of Piping Systems".

D. NEMA Compliance: Comply with applicable requirements of NEMA Std No's WC-1 and WC-2 pertaining to identification of power and control conductors.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):

1. Brady, W.H. Company

2. Panduit Corporation

3. or equal

2.02 ELECTRICAL IDENTIFICATION MATERIALS

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, provide single selection for each application.

B. Color-Coded Plastic Tape:

1. Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-½" wide.

a. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.

C. Cable/Conductor Identification Bands:

1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

D. Plasticized Tags:

1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-¼" x 5-⅝", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.

E. Self-Adhesive Plastic Signs:

1. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.

2. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.

3. Baked Enamel Danger Signs:

4. General: Provide manufacturer's standard DANGER signs of baked enamel finish on 20-gauge steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

F. Engraved Plastic-Laminate Signs:

1. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2. Thickness: ⅛", except as otherwise indicated.

3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART III - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of CEC and OSHA.

2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit 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.

C. 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. Use a black marker for normal power circuits a red marker for critical circuits, an orange marker for life safety circuits, and a green marker for equipment circuits.

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, see Section 09 91 23 of the specifications.

3. All junction and pull boxes for the fire alarm system shall be painted red. All raceway for the fire alarm system shall be labeled "Fire Alarm" in red letters on intervals not to exceed ten feet.

D. Cable/Conductor Identification:

1. Apply cable/conductor identification, including 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, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panel boards, shop drawings, contract documents, and similar previously established identification for project's electrical work. Refer to Section 26 05 19 of these specifications for color-coding requirements.

E. Operational Identification and Warnings:

1. Wherever required by OSHA or directed by the University, to ensure safe and efficient operation and maintenance of electrical systems, including prevention of misuse of electrical facilities equipment by unauthorized personnel, install self-

adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposed. Request a meeting with the University prior to substantial completion to coordinate warning requirements.

F. Danger Signs:

1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations identified by the University as constituting similar dangers for persons in or about project. Request a meeting with the University prior to substantial completion to coordinate danger sign requirements.

    a. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

    b. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

G. Equipment/System Identification:

1. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, ½" high lettering, on 1-½" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

    a. Electrical cabinets and enclosures.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate. Identification of flush mounted cabinets and panel boards shall be on the inside of the device.

3. Panel boards, individually mounted circuit breakers, and each breaker in the switchboards, secondary unit substations, and distribution panels shall be identified with an engraved plastic laminate sign. Plastic nameplates shall be multicolored laminated plastic with faceplate and core as scheduled. Lettering shall be engraved minimum ¼" high letters.

    a. 480/277-volt normal power equipment shall be identified with white faceplate with green core.

    b. 480/277-volt critical branch power equipment shall be identified with white faceplate with yellow core.

c. 480/277-volt life safety branch power equipment shall be identified with white faceplate with red core.

d. 480/277-volt equipment branch power equipment shall be identified with white faceplate with blue core.

e. 208/120-volt normal power equipment shall be identified with green faceplate with white core.

f. 208/120-volt critical branch power equipment shall be identified with yellow faceplate with white core.

g. 208/120-volt life safety branch power equipment shall be identified with red faceplate with white core.

h. 208/120-volt equipment branch power equipment shall be identified with blue faceplate with white core.

i. Equipment identification is to indicate the following:

1) Equipment ID abbreviation.

2) Voltage, phase, wires and frequency.

3) Emergency or other system.

4) Power source origination.

Example: Panel SLGHA1
480/277V, 3 Ø, 4 W
Life Safety System
Fed by EM1

j. Submit complete schedule with the shop drawings listing all nameplates and information contained thereon.

END OF SECTION

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SECTION 26 29 23

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

A. This specification is to cover a complete variable Frequency motor Drives (VFDS) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. It is required that the drive manufacturer have the following:

1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
2. An independent service organization.

B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years.

1.2 REFERENCES AND STANDARDS

A. Institute of Electrical and Electronic Engineers (IEEE), Standard 519-1992, IEEE Guide for Harmonic Content and Control.

B. Underwriters laboratories, UL508C.

C. National Electrical Manufacturer's Association (NEMA), ICS 7.0, AC Adjustable Speed Drives.

D. IEC 16800 Parts 1 and 2

1.3 ACTION SUBMITTALS

A. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit operations and maintenance data and parts list for each VFD type. Include this data in Maintenance Manual.

COMPLIANCE TO IEEE 519 – HARMONIC ANALYSIS FOR PARTICULAR JOBSITE INCLUDING TOTAL HARMONIC VOLTAGE DISTORTION AND TOTAL HARMONIC CURRENT DISTORTION (TDD).

1.5 QUALITY ASSURANCE

A. VFDs and options shall be UL listed as a complete assembly. VFD's that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses

B. CE Mark – The VFD shall conform to the European Union Electro Magnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

C. Acceptable Manufactures
   1. ABB ACH 580 Series
   2. or equal
      a. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

A. The VFD package as specified herein shall be enclosed in a UL Listed Type 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
   1. Environmental operating conditions: 0 to 40°C continuous. VFD's that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
   2. Enclosure shall be rated UL type 12 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable.

B. All VFDs shall have the following standard features:
   1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
   3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
   4. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming

time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

5. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
6. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
7. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
9. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors.
10. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
11. The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
12. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
13. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the

serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.

3. Two (2) programmable analog inputs shall accept current or voltage signals.
4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows: There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display “start enable 1 (or 2) missing”. The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.
7. Seven (7) programmable preset speeds.
8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
11. The VFD shall include password protection against parameter changes.

D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:

1. Start-up assistants.
2. Parameter assistants
3. Maintenance assistant
4. Troubleshooting assistant

E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Calculated Motor Torque
5. Calculated Motor Power (kW)
6. DC Bus Voltage
7. Output Voltage

F. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

G. Serial Communications

1. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.
2. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass modeover serial communications. A minimum of 15 field parameters shall be capable of being monitored.
3. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.
4. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value control, etc. Both the VFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The VFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.

H. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The onboard filters shall allow the VFD assemble to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

I. All VFDs through 50HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad.

J. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection and shall be provided in both drive and bypass modes.
2. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.
3. The drive / bypass shall provide single-phase motor protection in both the VFD and bypass modes.
4. The following operators shall be provided:
    a. Bypass Hand-Off-Auto
    b. Drive mode selector
    c. Bypass mode selector
    d. Bypass fault reset
5. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
    a. Power-on (Ready)
    b. Run enable (safeties) open
    c. Drive mode select damper opening
    d. Bypass mode selected
    e. Drive running
    f. Bypass running
    g. Drive fault
    h. Bypass fault
    i. Bypass H-O-A mode
    j. Automatic transfer to bypass selected
    k. Safety open
    l. Damper opening
    m. Damper end-switch made
6. The following relay (form C) outputs from the bypass shall be provided:

a. System started
b. System running
c. Bypass override enabled
d. Drive fault
e. Bypass fault (motor overload or underload (broken belt))
f. Bypass H-O-A position

7. The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.
8. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in Fireman's Override 2). The remote start/stop contact shall operate in VFD and bypass modes.
9. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.
    a. One mode forces the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.
    b. The second fireman's override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).
10. The VFD shall include a "run permissive circuit" that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
11. Class 20 or 30 (selectable) electronic motor overload protection shall be included.
12. There shall be an internal switch to select manual or automatic bypass.
13. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be the responsibility of the mechanical **Contractor**. The **Contractor** shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

B. Power wiring shall be completed by the electrical **Contractor**. The **Contractor** shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START UP -

A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

3.4 Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

3.5 WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number

END OF SECTION 26 29 23

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Fire Marshal's Office

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

Interim Life Safety (ILSM)

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

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

Unless otherwise noted below, these requirements apply to impairments of a duration extending beyond the current shift (greater than 8 hours)		ILSM1	ILSM2	ILSM3	ILSM4	ILSM5	ILSM6	ILSM7	ILSM8	ILSM9	ILSM10	ILSM11	ILSM12	ILSM13	ILSM14	ILSM15
Check all impairments that apply.																
	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*															

**** 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 impairment
ILSM 6	Provide additional fire fighting equipment (i.e. fire extinguishers)
ILSM 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	Increase surveillance of building, special attention to construction area & storage
ILSM 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 firefighting equipment
ILSM 11	Conduct one additional fire drill per shift per quart.
ILSM 12	Inspect & test *temporary* systems monthly. -Document testing
ILSM 13	Conduct education to promote awareness of building deficiencies, hazards & temporary measures
ILSM 14	Train those who work in the hospital to compensate for impaired structural or compartmental fire safety features
ILSM 15	OTHER:

Responsible Individual Signature: Date:	Fire Marshal's Office Signature: Date: