UC DAVIS HEALTH

UC DAVIS HEALTH
MIND IT NETWORK MODERNIZATION
BUILDING #25
9558940

UC DAVIS HEALTH BUILDING DEPARTMENT

APPROVED

REVIEWED FOR CODE COMPLIANCE
The set of plans and specifications must be kept on the job site at all times and it is unlawful to make any changes or alterations to the approved set without written permission from the Building Department.
The approval of this plan and specifications SHALL NOT be held to permit or approve the violation of any University Policy or State Building Code.

BY: Paul R. Menard AIA CBO DATE: 05/06/2024

PROJECT #: B24-0060

UC Davis Health
Sacramento, CA 95817

This approval includes 476 pages.

OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY

Jason Rizzi
UCDH DCFM

DATE: 05/09/2024

Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

PROJECT MANUAL

BACKCHECK NO. 2
DIVISION 00-02, 07, 09, 15, 26-27

HGA

HAMMEL, GREEN AND ABRAHAMSON, INC.
1200 R STREET, SUITE 100
SACRAMENTO, CALIFORNIA 95811
(916) 787-5100

HGA COMMISSION NUMBER

1500-164-01

APRIL 19, 2024

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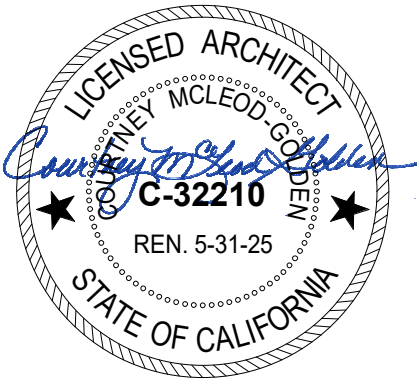
DOCUMENT 000105

CERTIFICATIONS PAGE

ARCHITECTURAL



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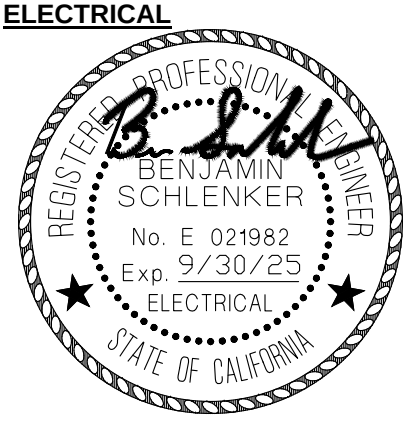

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SECTION 000110
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SECTION 01 11 00

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: MIND IT NETWORK MODERNIZATION

B. University Project No.: 9558940

C. Project is located at 2825 50th Street, UC Davis Health, Sacramento, California, as shown on the vicinity map.

D. Project is a Net V2 infrastructure upgrade in the MIND Institute Clinic & Resource Center Building (Building 25). Work to existing telecom rooms will upgrade electrical, IT, and mechanical systems. This includes but is not limited to relocating existing equipment racks, adding new racks, new UPS, new WAPs & cabling, receptacles, light fixtures, mini power zones, and power distribution units. New HVAC system installation and associated piping, as well as ceiling demolition are also included as part of this project. Work does not impact existing fire separation walls.

E. A description of areas, types of construction and general nature of the Work are described on drawing G000.

This project will require the contractor to work in and around occupied facilities. Any construction activities generating noise or vibration shall be completed at night.

F. Special Constraints and Criteria:

1. Refer to Section 011400 Work Restrictions for dates and hours when the building is occupied and operational, and work-shift hour requirements and restrictions.

2. Noise Mitigation shall be required when the building is occupied.

3. Egress shall not be restricted or impacted unless scheduled when the building is not occupied.

1.03 **Contractor** WARRANTS

A. **Contractor** warrants that it is skilled and experienced in the use and interpretation of Contract Documents such as those included in the bid documents for this Contract. The **Contractor** further warrants that it has carefully reviewed the Contract Documents for this Work and has found them to be free of ambiguities and sufficient for bid purposes.

B. **Contractor** warrants that it has inspected the Project Site and based on these observations, has satisfied itself as to the nature and location of the Work; and any special conditions likely to be encountered at the site which may affect the performance of the Work.

C. **Contractor** warrants that its bid is based solely on the Contract Documents provided, its own observations, and written explanations and interpretations obtained from University's Representative and not on any explanation or interpretation, oral or written, from any other source.

1.04 CONTRACT DOCUMENT INTENT AND RELATIONSHIPS

A. Contract Documents Intent: Provide all labor, material, equipment, tools, transportation, insurance, services, and all other requirements necessary to construct the project described in the Contract Documents.

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

C. Discrepancies in Contract Documents: In the event of error, omission, ambiguity, or conflict in the Contract Documents, **Contractor** shall bring the matter to University's Representative's attention in a timely manner, for University's Consultant's determination and direction in accordance with provisions of the General Conditions of the Contract.

D. Bidding and Contract requirements: Information for bidding, Conditions of the Contract and other Contract documents will be produced by University and may be included in the Contract Documents for convenience. Such documents are not Specifications. Specifications are found in Divisions 1 through 48 of the Contract, as listed in the Table of Contents of the Contract.

E. Contract Drawings: The Drawings provided with and identified in the Contract are the Drawings referenced in the Agreement.

1. Drawings produced for this project may encompass Civil, Landscape, Architectural, Structural, HVAC, Plumbing, Piping, Fire Protection, and Electrical portions of the Work. Interior Design drawings may also be provided for product selection and installation information.

2. The location, extent and configuration of the required construction and improvements are shown and noted on the Drawings. A list of Drawings is included in the Contract Documents.

3. Drawings are arranged according to design discipline. Such organization and all references to trades, subcontractor, specialty contractor or supplier shall not control the **Contractor** in dividing the work among subcontractors or in establishing the extent of the work to be performed by any trade.

4. Where the terms "as shown", "as indicated", "as noted", "as detailed", "as scheduled" or terms of like meaning, are used in the Drawings or Specifications, it shall be understood that reference is being made to the List of Drawings and the Specifications as bound in the Contract Documents.

5. Where reference to the word "plans" is made anywhere in the Drawings, Specifications and related Contract Documents, it shall be understood to mean the Drawings listed in the List of Drawings.

F. Contract Specifications: The Specifications provided as a part of the Contract Documents are the Specifications referenced in the Agreement.

1. The Specifications are organized by Division and Sections in accordance with recommended practice of the Construction Specifications Institute. Such organization shall not control the **Contractor** in dividing the work among subcontractors or in establishing the extent of the work to be performed by any trade.

2. Specifications are included in the Contract, which also includes other Bidding and Contract Documents. Contents of the Contract are listed in the TABLE OF CONTENTS.

3. Information for bidding, Conditions of the Contract and other Contract documents will be produced by University. Such documents are not Specifications. Specifications are found in Division 1 through 48 of the Contract.

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

A. University-Furnished Products: University will furnish, for installation by **Contractor**, products which may be identified on the Drawing and in the Specifications as UFCI (University-Furnished/**Contractor**-Installed).

1. Wireless Access Points

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 CONCURRENT WORK UNDER SEPARATE CONTRACTS – NOT USED

A. 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.

B. 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.

1.07 SITE CONDITION SURVEY & PROTECTION OF EXISTING IMPROVEMENTS

A. Site Condition Survey: Prior to commencing work, the **Contractor**, University's Representative and other University representatives shall tour the Project site together to examine and record the existing condition of site, adjacent buildings, and improvements. This record shall serve as a basis for determination of damage (if any) due to the construction process. The record shall be signed by all parties participating in the tour.

B. Protection of Existing Improvements: Locate all known existing utilities prior to proceeding with construction. Existing utilities shall be kept in service where possible and protected by the **Contractor** from damage. If any structure or utility is damaged, take immediate action to ensure the safety of persons and University property and effect repair. If previously undiscovered structures or utilities are encountered, request University's Representative to provide direction on how to proceed with the work. Cracks, sags or damage to adjacent structures or improvements not noted in the original survey shall be reported to University's Representative.

C. University does not normally charge for its shutdown support services. However, if poor planning or execution of a shutdown by **Contractor** causes excessive time and effort for University, University reserves the right to back charge **Contractor** for additional work.

1.08 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 p.m. to 5:00 a.m., Monday through Friday. Prior University approval is required for **Contractor** construction work at any other time or day.

C. Construction Limit: Limit construction activities to areas indicated on Drawings as Project Area or, if not indicated, to areas immediately adjacent to buildings and as necessary for immediate construction or utility services and sitework, See Section 015100 - TEMPORARY UTILITIES for additional requirements.

D. Utility Outages and Shutdowns: Schedule utility outages and shutdowns to times and dates acceptable to University's Representative. Duration of outages and shutdowns shall not hinder University normal business operations. Provide fourteen (14) calendar days' notice of all utility outages and shutdowns.

1.09 UNIVERSITY BENEFICIAL OCCUPANCY – NOT USED

1.10 PROJECT PHASING – NOT USED

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. Work is expected to be completed at night. No Work shall be done outside the night shift standard hours of Monday through Friday 7:00 p.m. to 5:00 a.m. No work shall be completed on holidays, weekends, or during the daytime 7:00 a.m. to 5:00 p.m. hours unless prior written approval has been obtained from the University's Representative.

1.02 PROJECT PHASING – NOT USED

1.03 WORK SEQUENCE and WORK RESTRICTIONS

a. The MIND Institute must remain operational at all times. Any work that will impact path of travel or building utilities must be approved by the University's Representative.

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 taken at all times that the building is occupied. Loud or unnecessary conversation shall be avoided. The playing of radios, or any audio devices shall be strictly prohibited. Noise, that in the sole opinion of the University's Representative, is disturbing or disruptive to occupants of the building shall be scheduled for periods when the building is not occupied.

B. **Contractor** shall control the conduct of its employees so as to prevent unwanted interaction initiated by **Contractor**'s employees with UCD staff, patients, students or other individuals, adjacent to the Project site. Without limitation, unwanted interaction by **Contractor**'s employees includes whistling at or initiating conversations with passersby. In the event that any **Contractor**'s employee initiates such unwanted interaction, or utilizes profanity, **Contractor** shall, either upon request of University's Representative or on its

own initiative, replace said employee with another of equivalent technical skill, at no additional cost to the University.

C. SMOKE AND TOBACCO-FREE ENVIRONMENT: The University of California Davis is committed to a healthy campus and workplace culture and environment. Effective January 2, 2014, the University of California Davis is a Smoke and Tobacco-Free environment. Smoking and the use of smokeless tobacco products (e.g., e-cigarettes and other unregulated nicotine products) is strictly prohibited on all University of California Davis-controlled properties, owned or leased and regardless of location. This policy is intended to provide a healthier, safer, and productive work and learning environment for the entire University of California Davis community. For more information on the Smoke/Tobacco-Free Policy, please visit (http://breathefree.ucdavis.edu). For more information on the President's Mandate and other related resources, please visit http://uctobaccofree.com/.

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

1.09 INTERRUPTION OF BUILDING SERVICES

A. Planned utility service shutdowns shall be accomplished during periods of minimum usage. In some cases, this will require Work activities before 8:00 a.m. and after 5:00 p.m. and weekend Work, at no additional cost to the University. At least 14 calendar days advance notice shall be given to the University's Representative before interruptions to utility service (refer to Utility Service Interruption/Shut Down Request) and other interferences with use of existing buildings, surrounding hardscape and roads.

B. Shutdowns critical to the completion of the project shall be listed as Milestones on the project schedule. The **Contractor** shall program. Work so that service will be restored in the minimum possible time and shall cooperate with the University in reducing shutdowns of utility systems.

C. The University reserves the right to deny shutdown requests based on scheduled workload, research projects, and usage of surrounding buildings or other activities planned on campus.

D. University's costs for initial planned utility service shutdowns shall be borne by the University. If repeat utility service shutdowns are required due to work necessary to correct **Contractor**'s defective work, mistakes in new work layout such as misalignment or installation conflicts with other new work, University's costs for repeat shutdown(s) will be deducted from Contract Sum.

1.10 SITE INGRESS AND EGRESS

A. Access to Project site shall be as indicated on the Drawings. Access to Project site is limited to designated routing on existing access roads. The **Contractor** and their employees, sub **Contractor'**s, 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 **Contractor**'s expense all signage barricades, lights, and flaggers required to control traffic and shall provide and maintain suitable temporary barricades, fences, directional signs, or other structures as required for the protection of the public; and maintain, from the beginning of twilight through the whole of every night on or near the obstructions, sufficient lights and barricades to protect the public and Work.

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

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 interpretation, clarification, instruction or decision is subject to removal and replacement at **Contractor** expense.

D. Failure to Agree: In the event of failure to agree to the scope of the Contract requirements, **Contractor** shall follow procedures set forth in Article 4 of the General Conditions of the Contract.

3.02 Refer to the following Attachment

A. Request for Information

END OF SECTION 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**

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

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 32 Week Look Ahead

        8) Potential Schedule Delay Issues

        9) Incomplete or Non-Conforming Work

        10) Inspection Requests

        11) Utility Shutdowns and Dig Notifications

        12) Instructional Bulletins and Field Orders

        13) Change Orders/Cost Proposals

        14) Payment Applications and As-Built Documents

        15) Miscellaneous Business

        16) Other items affecting progress of the Work

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

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

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

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

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

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

1.04 SUBMITTALS

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

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

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

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

C. Work Plans: Submit as specified herein.

1.05 COORDINATION

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

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

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

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

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

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

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

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

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

1.06 COORDINATION OF SUBCONTRACTORS AND SEPARATE CONTRACTS

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

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

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

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

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

1.07 UNIVERSITY CRITERIA

A. Equipment Coordination: **Contractor** and University supplied equipment will require complete installation data be exchanged directly between **Contractor** and vendors and subcontractors involved as progress of Project requires. Individual requesting information shall advise when it is required. Incorrect, incomplete, delayed or improperly identified equipment causing delay or error in installation will require entity causing such action to

be liable for modifications or replacements necessary to provide correct and proper installation, including relocations.

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

C. Interruption of Services: Construction Work shall accommodate University's use of surrounding and adjacent premises during the construction period and shall provide continuous public access and use of surrounding and adjacent facilities. **Contractor** shall not deny access to public use facilities until an alternate means of public use has been provided. An interruption of service is defined as any event which in any way interrupts, disrupts or otherwise discontinues, even momentarily, the services provided by University to its patients and staff. Adequate notice, as described below, shall be given to University when any interruption of services or interference with the use of existing buildings and roads are anticipated. Any interruption of 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.

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

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

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

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

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

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

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

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

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

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

        1) Non-normal times shall include, but not be limited to, periods of time before 7:00 a.m. and after 5:00 p.m. in the evening, weekend days, or legal holidays, or such periods of time which constitute split shifts or split working periods.

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

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

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

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

G. Detailed Work Plans: **Contractor** shall develop and submit for review and approval to University's Representative detailed work plans for specific work activities, both inside and outside the work area, associated with impact to, or interruption of services and operation, and dig activities. Work Plans shall be submitted as a PDF electronic file with Table of Contents indexed. Work Plans shall include written description of work activity, detailed schedule with proposed sequence of operation and activity duration, type of equipment to be used, a copy of site plan highlighted to indicate sequencing and location of work and equipment, completed Request for Shutdown and/or Dig Notification forms as applicable, conformance to ILSM, and control methods for noise, vibration and airborne contaminants.

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

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

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

   a. **Contractor** shall prepare and submit complete ¼" = 1' - 0" coordination drawings, including plans, sections, details as are appropriate indicating the area layout, complete with debris removal area and materials access points, and all mechanical and electrical equipment in all areas and within above and below ceiling spaces for new and existing conditions, including bottom of all ducts, plenum, pipe and conduit elevations.

Drawings shall show all structural and architectural components, restraints and other obstructions that may affect the work. Electronic or photo reproduction of University's Architectural Drawings is not acceptable.

b. **Contractor** and each Subcontractor shall ensure all relevant mechanical and electrical equipment, piping, conduit, fire sprinkler system, ceiling hangers, braces etc., are shown and will fit, together with necessary items such as lights, ducts, fans, pumps, piping, conduit and the like.

c. **Contractor** shall indicate all locations of expansion/ seismic joints and indicate how expansion for piping, conduit and other components is provided.

d. **Contractor** shall indicate all locations for access doors or other means of access at conditions above and below for items requiring access or service including but not limited to valves, mechanical equipment, electrical equipment valves and other components. The **Contractor** is responsible that piping, conduit, braces and other obstructions do not block access to items indicated above.

e. Submit completed and fully coordinated PDF electronic indexed file drawings with bookmarked Sheet Index together with **Contractor**'s comments indicating possible areas of conflict for review to University's Representative prior to start of work.

f. Penetrations: **Contractor** shall prepare a sleeving layout (¼" scale) indicating size and locations of sleeves. Trades shall indicate to **Contractor** their requirements and locations. PDF electronic files to applicable trades and University's Representative.

g. Completion of work: All coordination drawings shall be submitted together with record (as built) drawings of all trades involved in accordance with Section 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 Refer to the following attachments

A. Request for Shutdown (RFS) Info/Impact Report

B. Dig Notification Form

END OF SECTION 01 31 00

REQUEST FOR SHUTDOWN (RFS) INFO/IMPACT REPORT

PROJECT NAME: **MIND IT Network Modernization**

UNIVERSITY RFS# _____

PROJECT #: 9558940 **HCAI #:** N/A **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 #: _____ 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_____

SECTION 01 32 00

CONTRACT SCHEDULES

PART I - GENERAL

1.01 SCOPE

A. Preliminary Contract Schedule, Contract Schedule, updated Contract Schedules, Short Interval Schedules (SIS), Recovery Schedules and As Built Schedule.

B. Sub-networks of activities (Fragnets) supporting Time Extension Requests.

1.02 DEFINITIONS

A. Construction Schedule/CPM Schedule/Schedule: The most recent; Baseline Schedule, Updated Schedule or Revised Schedule.

B. Final Baseline Schedule: A final and ongoing Schedule for the project that has been reviewed and accredited by the University's Representative

C. Critical Work activities are defined as Work activities that, if delayed or extended, will cause a critical delay as defined in General Conditions Article 8. All other Work activities are defined as non-critical Work activities and are considered to have float.

D. Float is defined as the time that a non-critical Work activity can be delayed or extended without causing a critical delay as defined in General Conditions Article 8. Neither the **Contractor** nor the University shall have an exclusive right to the use of float. Float is a shared resource available to each party to the contract. The **Contractor** shall document the effect of the use of float on the updated Contract Schedule.

E. Recovery Schedule: Schedule required when any Revised Schedule or Update Schedule shows the work to be more than 14 calendar days behind the latest University-accepted contract end date

F. Short Interval Schedule (SIS): Schedule prepared on a weekly basis demonstrating the work accomplished the prior week and work planned for the upcoming three weeks.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 Shop Drawings, Product Data, Samples:

1. Proposed Scheduling Software and qualifications of individual preparing schedules.

2. Preliminary Contract Schedule

3. Contract Schedule including graphical and tabular reports.

4. Monthly Updates to Contract Schedule, including Narrative Report.

5. Short Interval Schedules

6. Final As-Built Schedule

B. Include an electronic version of all submittals required by this specification, including Narrative prepared in MS Word or .pdf format, CPM schedule in .xer file (P6 backup) or other schedule native file format if accepted under 1.3. A.1 above, .pdf of full schedule, and .pdf of critical path. The following fields shall be included:

1. Activity identification

2. Activity description

3. Duration, start, and finish dates.

4. Percentage of completion

5. Total float

6. Responsible party

7. Predecessors and successors

PART II - PRODUCTS

2.01 SOFTWARE

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

PART III - EXECUTION

3.01 PRELIMINARY CONTRACT SCHEDULE

A. Within 10 calendar days after the Notice of Selection as the Apparent Lowest Responsible Bidder, **Contractor** shall submit the Preliminary Contract Schedule in both native and .pdf format to the University's Representative for acceptance. The Preliminary Contract Schedule shall represent the **Contractor**'s plan for accomplishing the work within the Contract time showing all significant milestones for the Contract period as well as a detailed work plan for the first 90 calendar days following the Notice to Proceed. This detailed work plan shall identify in detail the following activities for the first 90 calendar days:

1. Preparation of equipment and material submittals for review. List Project submittals within Schedule per each specification section including Division 1 requirements. Indicate dates for submission of required submittals. Note: schedule shall include 18 calendar days for the University's review of the Preliminary Contract Schedule.

2. Make submissions within the following number of days after the Notice to Proceed:

    a. Items needed in initial stages of Work or requiring long lead-time for ordering: 30 calendar days.

    b. Deferred approval submittals, for review and approval by agencies such as University's when required: 60 calendar days.

    c. Electrical, mechanical and equipment items other than those covered by item "a" above: 60 calendar days.

    d. All other items: 90 calendar days.

3. Procurement schedule.

4. Critical Path for the first 90 calendar days.

B. The Preliminary Contract Schedule shall acknowledge significant known constraints and include all anticipated activities prior to the Notice to Proceed.

C. The Preliminary Contract Schedule shall not include any actual dates or progress measured against any activities.

D. Acceptance of the Preliminary Contract Schedule is a condition for approval of the first progress payment application.

E. The **Contractor**'s progress shall be measured against the Preliminary Contract Schedule until such time as the University accepts the **Contractor**'s first Contract Schedule. The Preliminary Contract Schedule shall be incorporated into the **Contractor**'s proposed Contract Schedule.

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

3.02 CONTRACT SCHEDULE (BASELINE)

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

B. Form

1. The proposed first contract schedule shall be produced using CPM (Critical Path Method) techniques, in the PDM (Precedence Diagram Method) method of scheduling. The Contract Schedule shall be calculated using the Retained Logic method. Progress override calculations shall not be acceptable. The schedule shall not use negative float or constraints on work activities.

2. The Contract Schedule shall identify all holidays and non-working days.

3. Identity of the party responsible for the activity (i.e., University, General **Contractor**, specific subcontractor, etc.)

4. The Contract Schedule activities shall be coded with the following information applicable to each activity:

a. Area of the project

b. Identity of the party responsible for the activity (i.e., University, General **Contractor**, specific subcontractor…)

c. Specification section applicable to activity

d. Phase

e. Sequence – The following sequences shall be identified:

1) Administrative

2) Submittal and Review

3) Fabrication

4) Construction: including phasing and sequencing as identified in 011400 Work Restrictions

5) Inspection, Commissioning, and Close-out

C. Content

1. The Contract Schedule shall identify all Work activities in correct sequence for the completion of the Work within the Contract Time. Work activities shall include the following:

   a. Major **Contractor**-furnished equipment, materials, and building elements, and scheduled activities requiring submittals or University's Representative's prior acceptance.

      1) Show dates for the submission, review, and approval of each such submittal. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by the University.

      2) The schedule shall allow submittal review time in accordance with Section 01 33 00 Shop Drawings, Product Data, Samples.

   b. System test dates.

   c. Scheduled overtime Work to the extent permitted by Contract Documents.

   d. Dates **Contractor** requests designated workspaces, storage area, access, and other facilities to be provided by the University.

   e. Dates **Contractor** requests orders and decisions from the University on designated items.

   f. Dates **Contractor** requests University-furnished equipment.

   g. Dates **Contractor** requests University-furnished utilities.

   h. Planned dates for shutdown, connection and relocation of existing utilities.

   i. Planned dates for connecting to or penetrating existing structures.

   j. Planned dates for scheduled inspections as required by Codes, or as otherwise specified.

   k. Commissioning Sequence and activities for all Building Systems.

2. Unless approved by the University's Representative, there shall be no activities shown with durations in excess of 7 calendar days (excluding submittals, submittal reviews, and procurement activities). Milestones should be listed for the completion of wings, floors, and other similar areas.

3. The allowable monthly rain days per the Supplemental Conditions shall be incorporated into the Schedule.

4. Identify types of calendars used and the logic of their application.

D. Submission

1. The first Contract Schedule shall be submitted to the University not later than 30 calendar days after Notice to Proceed. The period covered by Contract Schedule shall be the Contract Time as specified in the Notice to Proceed. The Contract Schedule shall incorporate the logic of the Preliminary Contract Schedule covering the first 90 calendar days following the Notice to Proceed. Items to be included with first submission:

   a. Contract Schedule (Baseline)

   b. Critical Path Schedule excluding all non-critical Work activities.

   c. Narrative

2. Tabular Computer Reports

   a. As requested by the University, the **Contractor** shall submit various computer-generated tabular reports.

   b. As requested by the University's Representative, the **Contractor** will be required to submit additional Schedule Reports.

E. Acceptance

1. Upon receipt, the University's Representative shall review the proposed first Contract Schedule. Within 21 calendar Days of the University’s receipt of the proposed first Contract Schedule, the University's Representative shall schedule a review meeting with the **Contractor** for the purpose of jointly reviewing the proposed first Contract Schedule.

2. If the proposed first Contract Schedule is accepted by the University's Representative, it shall become the Contract Schedule (or Baseline Schedule). Such acceptance shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the Contract Schedule.

3. If the **Contractor** or the University's Representative determines the proposed first Contract Schedule to need revision, the **Contractor** shall revise and resubmit the proposed first contract schedule to the University's Representative within 14 calendar days for acceptance. If accepted, it shall become the Contract Schedule. Such acceptance shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the Contract Schedule If not accepted the **Contractor** will resubmit within 10 calendar days for a new review period to start.

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

F. Schedule Logic

1. Activity schedule logic should normally be of Finish-to-Start relationship type and assembled to show order in which **Contractor** proposes to carry out the Work. The logic should indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials, and equipment. Form basis for assembly of schedule logic on the following criteria:

a. Indicate which activities must be completed before subsequent activities can be started.

b. Indicate which activities can be performed concurrently.

c. Indicate which activities must be started immediately following completed activities.

d. Indicate resource sequencing due to availability or space restrictions.

e. Lags shall not be used if can be represented with additional schedule detail. Finish-to-start logic ties with positive lags are not permitted. All positive time consumption should be represented by a schedule activity. Start-to-start, or finish-to-finish logic ties with negative lags are not permitted.

f. Lags in Start-to-Start or Finish-to-Finish relationships must not exceed the duration of the predecessor or successor activity, respectively.

G. Non-Sequestering of Float

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

H. Out of Sequence Logic:

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

I. Preferential Logic:

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

3.03 EXPERIENCE REQUIREMENTS

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

B. Within 14 calendar days after the Notice of Selection as the Apparent Lowest Responsible Bidder, **Contractor** shall provide the University with the identification, qualifications, and experience of and references for the proposed individual or consultant.

3.04 MONTHLY UPDATES

A. After acceptance of the first proposed Contract Schedule, **Contractor** shall update the Contract Schedule monthly. The update shall reflect progress as of the end of each month. **Contractor** shall submit monthly schedule update to the University's Representative for acceptance with the draft payment application and no later than the tenth day of the following month. The updates shall be made as follows:

1. The Monthly updates shall report progress based upon percent complete of each activity or remaining duration. Actual start dates shall be recorded for those activities that have started. Actual finish dates shall be recorded for those activities that are completed. Activities that are in progress shall reflect an actual start date and the percentage completion for the activity. Actual dates shall be clearly distinguishable from projected dates.

2. The updated Contract Schedule shall reflect an up-to-date status of the contract work as completed, and materials furnished and in permanent place that qualify for payment.

3. The updated Contract Schedule shall reflect Contract Time changes included in all processed change orders for the progress month and each preceding month.

B. Within 5 calendar days after receipt of the updated Contract Schedule in conjunction with the Application for Payment, the University's Representative shall review both and determine which work and material pay items qualify for payment; the approved data will then be returned to the **Contractor** for input. Within 14 *c*alendar days, the **Contractor** and the University's Representative shall meet to review the Construction CPM Schedule and discuss any changes required.

C. The **Contractor** shall then revise and resubmit (if required) the Updated Contract Schedule and Application for Payment to the University's Representative for payment approval.

D. The monthly update shall be calculated using retained logic with a required finish date specified as the current contract completion date. Progress Override calculations shall not be acceptable.

E. No Applications for Payment will be processed, nor shall any progress payments become due until updated Contract Schedules are accepted by University's Representative. The accepted, updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis for payment during that period. Acceptance of any updated Contract Schedules shall not relieve **Contractor** from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve **Contractor** from sole responsibility for any errors in the updated Contract Schedules.

F. **Contractor** shall perform the Work in accordance with the updated Contract Schedule. **Contractor** may change the Contract Schedule to modify the order or method of accomplishing the Work only with prior agreement by the University.

G. With each monthly updated Contract Schedule, the **Contractor** shall provide an accompanying narrative describing the progress anticipated during the upcoming month, critical activities, delays encountered during the prior month, delays anticipated during the upcoming month, and an audit of the Contract Time. The audit shall show current days allowed by contract, days used through the end of the month, days remaining, percent of time used to date, and percent complete as measured by cost loaded schedule, and days ahead of or behind schedule. In the event that the **Contractor** was delayed by any occurrence during the prior month, the narrative report shall include a listing of all delays that affected the critical path and shall clearly explain the impact the claimed delay(s) had on the critical path and shall include an accounting of days lost or gained.

H. In the event the monthly update shows the **Contractor** to be behind schedule (negative float), the narrative shall include a description of actions needed to bring the project back on schedule.

3.05 LOOK AHEAD SCHEDULES

A. Look Ahead Schedule is a schedule derived from the Contract Schedule (or the most current monthly update of the Contract Schedule) which indicates in detail all activities scheduled or worked on for the 1 prior weeks, and all activities scheduled to occur during the next 3 weeks.

B. Provide detailed Look Ahead Schedules every week.

C. Submit in 11-inch by 17-inch Gantt chart format.

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

3.06 TIME EXTENSION REQUEST DOCUMENTATION

A. In the event the **Contractor** shall request an extension of Contract Time, **Contractor** shall comply with the requirements of the General Conditions, including without limitation, General Conditions Article 8. In addition to the requirements of the General Conditions, as a condition to obtaining an extension of the Contract Time, **Contractor** shall timely submit a sub-network of the events of the delay that demonstrates the impact to the activities in the **Contractor**'s then current schedule, as well as the impact to the overall completion date of the project.

B. If the University's Representative approves the extension of time, the next monthly updated Contract Schedule shall incorporate the subnetwork with the extension of time. In addition, the monthly updated Contract Schedule shall contain all changes mutually agreed upon by the **Contractor** and the University during preceding periodic reviews and all changes resulting from Change Orders and Field Orders.

3.07 AS BUILT SCHEDULE

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

3.08 WEATHER DAYS ALLOWANCE

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

B. The expected loss of days specified in the Supplementary Conditions, item 3 “Modification of General Conditions, Article 8 – Contract Time”, shall be included in a separate identifiable critical activity labeled "Weather Days Allowance" to be included as the last critical activity of the project schedule prior to substantial or final completion (whichever is contractual). The weather allowance activity shall be on, and remain on, the critical path of the project throughout the life of the project until it has been absorbed. Typically, all activity’s leading to completion shall go through the weather allowance activity first. When weather days are experienced, and are approved as such by the University’s Representative, the **Contractor** shall either:

1. Increase the duration of the current critical activity(ies) by the number of weather days experienced, or

2. Add a critical activity to the schedule to reflect the occurrence of the weather day(s).

C. The duration of the weather day allowance activity shall be reduced as weather days are experienced and included in the schedule. Any remaining weather days in the weather day allowance activity at the completion of the project shall be considered as float and shall not be for the exclusive use or benefit of either the University or **Contractor**.

D. The **Contractor** shall not receive any additional compensation for unavoidable delays due to inclement or unsuitable weather. If all the weather allowance has been used, any additional weather delay experienced by the **Contractor** may result in a non-compensable time extension upon submission of acceptable supporting documentation to the University’s Representative.

END OF SECTION 01 32 00

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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.

B. Related sections include the following:

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

2. Division 01, Section “Closeout Submittals.”

1.02 PROGRESS PHOTOS/VIDEOS

A. Maintain a **daily** photographic record of the progress of the Work as outlined in Part III of this Section.

1. Photographs to accompany Superintendent Daily Reports will be done on a daily basis.

1.03 AS-BUILT DOCUMENTATION

A. The Contractor shall be responsible for the maintenance and completion of As-Built PDF Drawings and Models 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 and in the record model by the Contractor. Such indications shall be neatly made and kept current. Where exact locations are critical, such as in the case of buried piping or conduit, such locations - both horizontal and vertical - shall be dimensioned back to an above ground, permanent fixed point.

3. Properly note construction deviations or changes on the monthly As-Builts, prior to proceeding with any Work in those locations. Do not complete Work or request inspections if such Work has been installed in locations contrary to the Drawings.

4. University's Representative may request to review the As-Builts, on a monthly basis and prior to each Application for Payment. If requested by University's Representative, provide access to the following:

a. Approval of Application for Payment is contingent upon timely review of monthly changes on As-Builts Drawings and Record Models.

b. PDF drawings and The Record Model must be available for review to the University's Representative of the sheets or areas on which changes have been noted during the preceding month.

5. All As-Built and Record indications shall be clear and legible.

6. 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.

END OF SECTION 01 32 20

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

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 situation during the construction of projects at UC Davis Health.

1.02 This procedure applies to all Contractors and their subcontractors who have contractual agreements with UC Davis Health.

PART II - DEFINITIONS

2.01 Disaster – any natural or human-made event that causes major disruption such as damage to the organization's buildings or grounds from severe weather conditions, earthquakes, other natural phenomena or loss of utilities (power, water and telephones), acts of civil disobedience, accidents or emergencies within the organization or in the surrounding community.

2.02 Code Green – a code notifying all employees that an emergency event has occurred, and University operations will be opening the Hospital Command Center and shifting to emergency operations.

2.03 Code Red – Fire

2.04 Code White – Hazardous Material / Chemical Spill

2.05 Control Facility – the County of Sacramento has designated UC Davis Health as the Control Facility for Sacramento County. The Control Facility coordinates medical control of patients and victim's dispersal to hospitals in the community/region.

2.06 Other emergency situations include the following systems failures as outlined in the UC Davis Emergency Response Plan.

A. Water system failure
B. Telephone system failure
C. Fire
D. Electrical system failure
E. Security
F. Chemical spill
G. Evacuation

PART III - PROCEDURES

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

A. Pre-construction meeting. This plan must be posted at the project site at all times in a visible location known to all project contractors.

B. **Contractor** is directed to contact appropriate emergency personnel as outlined in the Emergency Response Plan information during an emergency.

C. If the emergency involves an outside utility company, **Contractor** is to contact utility company directly. Known outside utilities located at the Sacramento campus are as follows.

1. Emergency Telephone Numbers

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

END OF SECTION 01 34 00

SECTION 01 35 00

SPECIAL PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Interim Life Safety Measures (ILSM)

B. Security Procedures

C. Hazardous Materials Procedures

1.02 RELATED SECTIONS

A. General Conditions of the Contract

B. Section 011100 – SUMMARY OF THE WORK

C. Section 013100 – COORDINATION

D. Section 013200 – CONTRACT SCHEDULES

E. Section 015600 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS

F. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

G. Section 017300 – CUTTING AND PATCHING

H. Section 017400 – CLEANING

1.03 INTERIM LIFE SAFETY MEASURES (ILSM)

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

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

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

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

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

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

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

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

D. Any impairment or shutdown of a passive or active fire and life safety device/system for a period of 4 hours or longer in a 24 hour period will require implementation of an ILSM. Some of the most common impairments are outlined below. The listing of these ILSM examples is not intended to limit or preclude preventative actions that may be required to temporarily compensate for other life safety deficiencies that may arise during construction activities due to unforeseen conditions, the contractor's changing work plan, or required continuing activities of University. Comments following each ILSM are known ILSM requirements at time of bid. These comments are made to assist **Contractor** in bid preparation and later preparation of ILSM plan for the Project. University makes no guarantee these comments address all conditions requiring action by **Contractor**.

1. ILSM example #1: Ensure exits provide free and unobstructed egress. Maintain free and unobstructed access and exits from all buildings to public ways. Maintain escape facilities for construction workers at all times. Inspect means of egress in construction areas daily.

2. ILSM example #2: Maintain free and unobstructed access to emergency departments/services.

3. ILSM example #3: Ensure fire alarm, detection, and suppression systems are not impaired.

4. ILSM example #4: Ensure temporary construction partitions are smoke tight and built of noncombustible or limit combustible material that will not contribute to the

5. ILSM example #5: Provide additional firefighting equipment and use training for construction workers.

6. ILSM example #6: No smoking. **Contractor** shall follow the Universities smoking policy.

7. ILSM example #7: Develop and enforce storage, housekeeping, and debris removal practices that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operations.

8. ILSM example #8: Conduct a minimum of two (2) fire drills per shift per quarter.

9. ILSM example #9: Conduct regular hazard surveillance of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field office.

10. ILSM example #10: Train personnel when structural or compartmentalization features compromise fire safety measures.

11. ILSM example #11: Conduct organization-wide safety education programs to ensure awareness of any LSC (Life Safety Control) deficiencies, construction hazards, and ILSM.

1.04 SECURITY PROCEDURES

A. Security Program: Protect Work, existing premises, and University operations from theft, vandalism, and unauthorized entry.

1. Security of the area shall be strictly maintained. **Contractor** shall control entrance of persons and vehicles related to University operations.

B. Entry Control: Restrict entry of persons and vehicles into Project site and existing facilities. Allow entrance only to authorized persons with proper identification. Maintain log of workers and visitors, make available to University's Representative.

1. **Contractor** shall control entrance of persons and vehicles related to University operations.

C. Personnel Identification: Provide identification card to each person authorized to enter premises, showing: Personal photograph, name and assigned number, expiration date, and employer. Maintain a list of accredited persons; submit copy to University's Representative on request.

D. Miscellaneous Restrictions: Do not allow cameras on site; do not allow photographs except with written approval of University.

1.05 HAZARDOUS MATERIALS PROCEDURES

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

A. Spills, discharges, overruns, or similar occurrences involving hazardous materials on site shall be promptly reported in writing to University's Representative. If **Contractor** fails to notify University in a prompt and timely manner of an occurrence, University will contract with licensed hazardous materials abatement contractor to clean up the hazardous material. **Contractor** shall pay all costs of removal, including financial penalties incurred, the result of the **Contractor**'s failure to act promptly in response to the product emergency.

C. **Contractor** shall provide means and personnel to contain and control product emergencies or shall provide means and methods to render hazardous materials harmless.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 35 00

SECTION 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** 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

1.07 DEFERRED APPROVAL – NOT USED

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 41 00

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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 Standards used in Contract Documents

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

1.02 RELATED SECTIONS

A. Section 014100 – Regulatory Requirements

1.03 DEFINITIONS OF TERMS

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

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

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

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

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

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

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

6. Construction Site: Same as site.

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

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

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

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

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

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

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

13. Jobsite: Same as site.

14. Necessary: as determined in the professional judgement of the University Representative through the University's Consultant as being necessary for the Work, in conformance with the requirements of the Contract Documents, and excluding matters regarding the means, methods, techniques, sequences and procedures of construction.

15. Noted: Same as indicated.

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

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

18. Products: Materials, systems or equipment.

19. Project site: Same as site.

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

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

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

23. Required:

    a. As required by regulatory requirements of governing authorities.

    b. As required by referenced standards.

    c. As required by existing job conditions.

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

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

    f. As otherwise required by the Contract Documents.

24. Scheduled: Same as indicated.

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

26. Shown: Same as indicated.

27. Site: Same as Site of the Work or Project Site; the area or areas or spaces occupied by the Project and including adjacent areas and other related areas occupied or used by the **Contractor** for construction activities, either exclusively or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

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

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

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

1.04 REFERENCE STANDARDS

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

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

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

D. Copies of Reference Standards:

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

E. Jobsite Copies:

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

F. Edition Date of References:

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

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

G. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision or amendment. It is the responsibility of the **Contractor** to be familiar with and have access to these nationally, and industry recognized specifications and standards.

1.05 ABBREVIATIONS & ACRONYMS

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

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

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

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

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

END OF SECTION 01 42 00

SECTION 01 45 00

QUALITY CONTROL

PART I - GENERAL

1.01 SECTION INCLUDES

A. **Contractor**'s Quality Control

B. Quality of the Work

C. Inspections and tests by governing authorities

D. Inspections and tests by serving utilities

E. Inspections and tests by manufacturer's representatives

F. Inspections and Independent testing and Inspection Laboratories/Agencies

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

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

I. Test reports

J. Geotechnical engineer

1.02 RELATED SECTIONS

A. Section 013100 – COORDINATION

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

C. Section 014550 – INSPECTION and TESTING of WORK

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

1.03 [CONTRACTOR'S] [CM/CONTRACTOR'S] QUALITY CONTROL

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

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

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

1.04 QUALITY OF THE WORK

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

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

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

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

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

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

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

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

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

4. Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by University's Representative or University's Consultant.

5. Contract modifications, if any, resulting from such verification activities shall be governed by applicable provisions in the General Conditions of the Contract.

G. Observations by University's Consultants: Periodic and occasional observations of the Work in progress will be made by University's Consultant and their consultants as deemed necessary to review progress of Work and general conformance with design intent.

H. Limitations on Inspections, Tests and Observations: Neither employment of independent testing and inspection agencies nor observations by University's Consultant and their consultants shall relieve **Contractor** of obligation to perform Work in full conformance to all requirements of Contract Documents.

I. Acceptance and Rejection of Work: University's Representative reserves the right to reject all Work not in conformance to the requirements of the Contract Documents.

1. If initial tests or inspections made by University's Testing Laboratory or Geotechnical Engineer reveal any portion of the Work fails to comply with Contract Documents, or if it is determined that any portion of Work requires additional testing or inspection, additional tests and inspections shall be made as directed by University's Representative.

2. If such additional tests or inspections establish such portions of the Work comply with Contract Documents, all costs of such additional testing or inspection will be paid by University.

3. If such additional tests or inspections establish such portions of the Work fail to comply with Contract Documents, all costs of such additional tests and inspection shall be deducted from the Contract sum.

J. Correction of Non-conforming Work: Non-conforming Work shall be modified, replaced, repaired or redone by **Contractor** at no change in the Contract Sum or Contract time.

K. Acceptance of Non-Conforming Work: Acceptance of non-conforming Work, without specific written acknowledgement and approval of University shall not relieve **Contractor** of the obligation to correct such Work.

L. Contract Adjustment for Non-conforming Work: Should University or University's Consultants determine it is not feasible or in University's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between University and **Contractor**. If equitable reduction in Contract Sum cannot be agreed upon, a Directed Change Order will be issued and the amount in dispute resolved in accordance with applicable provisions of the General Conditions of the Contract.

1.05 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

A. Regulatory Requirements for Testing and Inspection: Comply with California Building Code (CBC) requirements and all other requirements of governing authorities having jurisdiction.

B. Inspections and tests by governing Authorities: **Contractor** shall cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.

1. Such authorities include University's Building Inspection (code compliance), University's Fire Marshal’s office and similar agencies.

1.06 INSPECTIONS AND TESTS BY SERVING UTILITIES

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

1.07 INSPECTIONS AND TEST BY MANUFACTURER'S REPRESENTATIVES

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

1.08 INSPECTION BY INDEPENDENT TESTING AND INSPECTION LABORATORIES

A. Definitions:

1. The term "University's Testing Laboratory" means a testing laboratory retained and paid for by University for the purpose of reviewing material and product reports, performing material and product testing and inspection, and other services as determined by University.

B. University will select an independent testing and inspection laboratory or agency to conduct tests and inspections as called for in the Contract Documents and as required by governing authorities having jurisdiction.

1. Responsibility for payment for tests and inspection shall be as indicated in the schedule below. All time and costs for **Contractor**'s services related to such tests and inspections shall be included in Contract Time and Contract Sum.

C. **Contractor** shall notify University, and if directed by University's Representative testing and inspection laboratory, when Work is ready for specified tests and inspections.

D. **Contractor** shall pay for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:

1. **Contractor**'s failure to properly schedule or notify testing and inspection agency or authority having jurisdiction.

2. Changes in sources, lots or suppliers of products after original tests or inspections.

3. Changes in means, methods, techniques, sequences and procedures of construction that necessitate additional testing, inspection and related services.

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:

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.

1.12 GEOTECHNICAL ENGINEER – NOT USED

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 45 00

SECTION 01 45 20

SEISMIC CONTROL – NON-HCAI

PART I - GENERAL

1.01 DESCRIPTION

A. Provide all required seismic restraints and calculations in order to ensure that the installation is in compliance with all applicable seismic codes, standards, and specific information listed herein.

1.02 QUALITY ASSURANCE

A. ASTM standards

B. 2022 California Building Code, Title 24 (CBC)

1.03 SUBMITTALS

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

PART II - PRODUCTS

2.01 SEISMIC RESTRAINT REQUIREMENTS

A. SUMMARY

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

2. The Design-Builder’s, Design Professionals are the designers of record as referenced in this specification shall be the project architect, structural engineer and the appropriate system engineer (e.g., electrical etc.).

3. Department of Health Care Access and Information (HCAI) pre-approved designs may be submitted as an alternate provided they meet or exceed all the requirements contained within these specifications, and provided they meet or exceed all of the HCAI pre-approved service loads, installation applications, engineering services, etc. Furthermore, said other HCAI pre-approved designs must be submitted to the designers of record for review and acceptance, and to the University as a deferred approval prior to installation, with all costs including but not limited to project delay costs, to be borne by the contractor.

4. Channel framing materials, fittings and related accessories shall be as indicated on the drawings. All channel members (trapezes and braces) shall be solid strut. Field drill bolt holes at 1/16” larger than bolt size as required for connections.

B. SEISMIC RESTRAINT DESIGN

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

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

   b. Attachment, supports, and seismic restraints that are not shown on the approved construction document shall be engineered and built by the applicable system contractor. Engineering shall be performed (signed & sealed) by a licensed California Structural Engineer and submitted to the designers of record and the University for acceptance prior to installation. Cost to be borne by the contractor.

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

2. Seismic restraint transverse and/or longitudinal spacing shall not exceed CBC requirements and the lesser of the following:

   a. That which develops seismic design forces equal to or less than the capacity of the building structure.

   b. That which develops seismic design forces that are equal to or less than the capacity of weakest part, component, anchorage, etc., contained within the seismic brace assembly.

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

   d. 20 feet transversely and/or 40 feet longitudinally where pipes, conduits, and their connections are constructed of nonductile materials (e.g., cast iron, no-hub pipe and plastic).

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

3. **Contractor** shall not adopt, use, or otherwise implement the omission of any seismic restraints without prior review and acceptance by the designers of record. Submittals for omission of seismic restraints shall be limited to piping, ducts, and conduits. All submittals for omission of seismic restraints must be signed and sealed by a licensed California Structural Engineer, approved by the University and include the following items:

   a. Project-specific cover letter clearly indicating that said engineer has (with respect to the attached submittal for omission of seismic restraints) completely review the project documents including these specifications, the items/systems designs individually and in coordination with all other trades, and that all code and/or project specified requirements for omission of restraints have been meet individually and in combination with each other, that (if the attached submittal for omission is approved)

said engineer has been hired/retained by contractor to visit the project site without limit to review and inspect the installation of the items/systems which have been reviewed and approved for installation without seismic restraints.

b. Engineered details and engineering for all vertical supports and their connections to the building structure to qualify, that top connections cannot develop moments, that lateral motion will not cause loss of item/system support, that lateral motion of the item/system will not cause damaging impact with other items/systems, that lateral motion of the item/system will not directly or indirectly impact any life safety, emergency services and/or hazardous items/systems or their supports.

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

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

6. Seismic restraint cables shall be looped through the seismic hardware bracket and turned back onto itself at the point of assembly/connection. Cables shall not be installed or attached to the seismic hardware bracket in a straight through (non-turn back) method of assembly/connection.

7. Seismic hardware brackets, connectors and related components shall be constructed entirely of malleable iron or steel. Seismic assemblies shall not include the use of cast components.

8. Ceiling and other types of single strand wire shall not be used as a seismic restraint, sway brace and/or safety restraint material.

9. The connection to the building structure of non-seismic sway bracing and/or safety restraints shall meet or exceed that required for the attachment of seismic restraints to the building structure.

10. Seismic restraints shall be installed to provide a minimum of (2) transverse and (1) longitudinal braces per run. A “run” shall be defined as a length of 5 feet or more.

11. The accumulated load of multiple items to any given support (with or without seismic restraints) shall be limited so as not to overload the building structure and the support assembly.

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

13. Vertical supports shall be designed and installed to account for vertical tension and compression loads including accumulated seismic component increases.

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

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

C. ACCEPTABLE MANUFACTURERS

1. HCAI pre-approved certified manufacturer (OPM)

D. ANCHORS, INSERTS AND FASTENERS

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

2. Do not use any anchor or insert in concrete or metal decking with concrete fill, which does not have a signed structurally engineered design value based on its installed application and one of the following:

a. ICC evaluation report

b. HCAI pre-approved

3. Cast-in-place inserts used in concrete or metal decking with concrete fill, shall be constructed entirely of malleable iron or steel.

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

5. Cast-in-place inserts that allow for horizontal adjustment shall not be allowed unless an engineered solution is provided to assure positive captive positioning and securement of the attachment.

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

7. All beam clamps shall be constructed of malleable iron or steel. All single flange mounted beam clamps shall include a retaining strap or J-hook and must be submitted to the project structural engineer of record of review and acceptance prior to installation. Beam clamps shall not be used to resist seismic loads.

E. FIELD QUALITY CONTROL

1. Inspection of seismic restraints by the Inspector of Record (IOR), and/or (AHJ) Authority Having Jurisdiction.

PART III - EXECUTION

3.01 SEISMIC ANCHORING AND RESTRAINTS

A. Equipment anchors:

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

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

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

B. Conduit supports:

1. Conduits shall be supported and braced per CBC Title 24.

C. Lighting fixture supports:

1. Provide independent seismic support system for all lighting fixtures.

D. Minimum Clearance:

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

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

3.02 INSTALLATION AND TESTING OF MECHANICAL ANCHORS:

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

B. All post-installed concrete anchors shall be tested. Testing shall be performed in the presence of the Inspector of Record. Number of anchors to be tested shall be as shown on the drawings with a minimum of 50% of anchors installed and at each support. Testing shall be performed by torque or pull test, and to the values noted on the drawings. Test loads, frequency, procedure, and acceptance criteria of post-installed anchors in concrete shall be in accordance with CBC 1901.3.4.

END OF SECTION 01 45 20

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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 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 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. 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.

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

B. Methods of Inspection Notification:

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

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

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

D. Re-inspections:

1. More than two (2) re-inspections: The cost of re-inspections of the same work, more than twice, shall be deducted from Contract Sum. IOR's hourly rates are $153.00 per hour during normal work hours and $229.50 per hour for all off-hour inspections. University will provide itemized invoice for **Contractor**'s records.

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

PART II - PRODUCTS – Not Applicable to this Section.

PART III - EXECUTION

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 – NOT USED

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 Name: _____ **Spec Section** _____

To: UC Davis Health	**From:**
Facilities Design & Construction – Inspection Trailer	
4430 V Street, Building 35	
Sacramento, CA 95817	
P: 916-734-5060	**P:**
Email: lfuka@ucdavis.edu & Project IOR	**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[Design- Builder]'s Superintendent prior to notification of Inspection Request.

Signed: _____ **Date:** _____

UNIVERSITY USE ONLY

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

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

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

Comments: _____

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

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

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

NON-CONFORMING WORK NOTICE

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

To: UCDH PM, Michael Gomez HGA, Courtney McLeod-Golden	**From: UC Davis Health** **Facilities Design & Construction** **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:

SECTION 01 51 00

TEMPORARY UTILITIES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Temporary Power and Lighting.

B. Temporary Heating, Cooling & Ventilation.

C. Temporary Water.

D. Temporary Fire Protection.

E. Temporary Telephone, Data, and WIFI.

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

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

C. Section 015610 – AIRBORNE CONTAMINANTS CONTROL

D. Section 017400 – CLEANING

E. Section 017700 – CLOSEOUT PROCEDURES

1.03 TEMPORARY UTILITIES

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

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

1.04 TEMPORARY POWER AND LIGHTING

A. Service Requirements:

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

    a. Install initial services at time of site mobilization.

    b. Modify and extend systems as Work requires.

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

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

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

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

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

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

5. Temporary Lighting: Construction lighting shall be supplied and maintained by **Contractor** at **Contractor**'s expense. Sufficient lighting levels shall be provided to allow construction to be properly and safely performed. **Contractor** shall give special attention to adequate lighting for stairs, ladders, floor openings, basements and similar spaces. Promptly replace burnt out, worn or defective parts.

6. Lighting fixtures: Locate fixtures in areas of Work: One (1) lamped fixture in rooms, except closets and utility chases; one (1) lamped fixture for every 750 square feet in large areas.

7. Security Lighting: **Contractor** shall provide security lighting during hours of low visibility.

B. Distribution requirements:

1. Wiring, connections and protection for temporary power and/or lighting.

2. 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 by the use of an improper wrench or other misuse of the hydrant must be repaired at contractor expense. **Contractor** must inspect hydrant prior to use and make the University aware of any pre-existing damage.

C. Use of Existing System: Existing system may be used for temporary water. Monitor usage to prevent interference with University's normal operational requirements.

D. Use of Permanent System: **Contractor** shall obtain written agreement from University establishing start of warranty period and conditions of use.

E. **Contractor** shall pay for installation, operation maintenance and removal of system and restoration of existing and permanent equipment. University will pay costs of water consumed for normal construction operations. **Contractor** shall take measures to conserve usage.

1.07 TEMPORARY FIRE PROTECTION

A. Requirements:

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

2. Provide and maintain fire protection equipment including extinguishers, fire hoses and other equipment as necessary for proper fire protection during course of the Work.

3. Use fire protection equipment only for fighting fires.

4. Locate fire extinguishers in field offices, storage sheds, tool houses, other temporary buildings and throughout construction site. In area under construction, provide at least one (1) fire extinguisher for each 5,000 square feet of building floor area. Locate fire extinguishers so that a person never has to walk more that seventy-five (75) feet to obtain one.

5. Assign qualified person with authority to maintain fire protection equipment, institute fire prevention measures, and direct prompt removal of combustible and waste material. Submit ILSM requirements per Specification SECTION 013500 – SPECIAL PROCEDURES.

1.08 TEMPORARY TELEPHONE, DATA, INTERNET, and WIFI

A. Service Requirements:

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

2. **Contractor** shall select from the following options:

a. University shall provide conduit, cabling and dial tone to **Contractor**'s location(s). **Contractor** shall pay University for cable, conduit installation and later removal of same and also pay University a monthly fee for use of University telephone, data internet, and WIFI system.

b. University shall provide conduit and cabling to **Contractor**'s location(s). **Contractor** shall receive dial tone from local utility. **Contractor** shall pay University for cabling, conduit installation, maintenance of same and later removal of same. **Contractor** shall pay local utility for monthly telephone, data, internet and WIFI service.

3. **Contractor** shall select number of lines, instruments and other features.

4. **Contractor** shall prepare and submit to University an itemized request for telephone lines (according to option 2a or 2b above) and internet service. Project Manager will submit a service request to the IT department.

B. Use of Existing System: Existing University telephone system shall not be used for temporary telephone service.

C. **Contractor** Phone:

1. **Contractor** shall have telephone emergency number or other facility available at **Contractor**'s business office for duration of contract where contractor and superintendent may be contacted within twenty-four (24) hours. Provide emergency numbers to University.

D. Telephones:

1. **Contractor** shall use, and only permit to be used, FCC approved communication devices on frequencies approved by FCC and University.

2. **Contractor** shall not use, or permit to be used, communication devices which interfere with existing University communication systems, including, but not limited to:

a. Life Flight or CHP helicopters.

b. Emergency Service vehicle communications.

c. Plant Operations & Maintenance communication devices.

d. Microwave transmission stations.

e. UC Davis Health closed-circuit television or radio signals.

f. Cellular or other mobile phone systems in main hospital.

g. UC Davis Health voice or digital paging systems.

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

PART II - PRODUCTS

2.01 MATERIALS

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

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

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

D. Modems compatible with internet service.

PART III - EXECUTION

3.01 INTERRUPTION OF EXISTING SERVICES

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

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

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

3.02 REMOVAL OF TEMPORARY CONSTRUCTION

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

END OF SECTION 01 51 00

SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART I - GENERAL

1.01 SECTION INCLUDES

A. Construction Parking and Access Roads

B. Traffic Regulation

C. Project Informational Signs

1.02 RELATED SECTIONS

A. Section 011100 – SUMMARY OF THE WORK

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

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

D. Section 017400 – CLEANING

E. Section 017700 – CLOSEOUT PROCEDURES: Project Closeout.

1.03 PARKING AREAS AND ACCESS ROADS

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

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

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

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

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

C. Existing Pavements and Parking Areas: Designated existing on-site streets and driveways may be used for construction traffic. Vehicles with metal tracks will not be allowed.

1. Designated areas of existing parking facilities may be used by construction personnel. Do not allow heavy vehicles or construction equipment in parking areas.

2. Maintain traffic and parking areas in a sound condition, free of excavating material, construction equipment, products, mud, snow and ice.

3. Maintain existing and permanent paved areas used for construction. Repair existing facilities damaged by usage to original condition: promptly repair breaks, potholes, low areas, standing water and other deficiencies, to maintain paving and drainage in original or specified condition.

4. Remove temporary materials and construction when permanent paving is usable.

1.04 TRAFFIC REGULATION

A. Schedule of Access Closing: **Contractor** shall adopt all practical means to minimize interference to traffic. Access to other facilities in the area shall be maintained at all times. **Contractor** shall provide schedule of planned closing of any street for approval by University and shall give minimum of fourteen (14) calendar days' notice before closing any street or access.

B. Use of Fire Lanes: **Contractor** shall notify University of all major pickups and deliveries that require use of controlled access fire lanes. Keys to gates or other barriers will be provided, as needed, to allow use of fire lanes. Vehicles parked in fire lanes for delivery of materials shall be continuously manned for immediate removal if required by the University.

1. Fire Lanes to remain open at all times and shall not be blocked without a Traffic Control Plan provided prior to work at the Fire Lane and approved by the University's Representative.

C. All major pick-up and delivery operations shall occur in total before or after normal working hours.

1. Drawings may indicate haul routes designated by University for use of construction traffic. Confine construction traffic to haul routes.

2. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

D. Post-mounted and wall-mounted traffic control and informational signs as specified herein.

1. Traffic Control Signs, Traffic Message Boards, Cones, Drums, Flares, Lights and Flag Control equipment: All as approved by California MUTCD requirements.

2. **Contractor** shall furnish at all barricades: Lights and flag control required to control traffic, and shall also provide and maintain suitable temporary barricades, fences, directional signs, or other structures as required for protection of the public; and maintain from the beginning of twilight throughout the whole of every night on or near the obstructions, sufficient lights and barricades to protect the public and/or the Work.

E. Construction Vehicle Parking: Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and University's operations. Prevent parking on or adjacent to roads or in non-designated areas.

F. Flag Control: Provide properly trained and equipped flagmen to regulate vehicular traffic when construction operations or traffic encroach on public traffic ways.

1. Provide properly trained and equipped personnel to regulate pedestrian traffic at all interior locations where construction traffic interfaces with University traffic.

2. Flag control personnel shall wear appropriate identifying clothing such as bright colored vests, clearly visible and identifiable as having responsibility for traffic control.

G. Lights: Use lights during hours of low visibility to delineate traffic lanes and to guide traffic.

H. Traffic Signs and Signals: At approaches to site and on site, install traffic signs and signals at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

1. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under **Contractor**'s control, and areas affected by **Contractor**'s operations.

2. Relocate traffic signs and signals as Work progresses, to maintain effective traffic control.

3. Remove equipment and devices when no longer required. Repair damage caused by installation.

1.05 PROJECT INFORMATIONAL SIGNS – NOT USED

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:

A. Refer to attached Infection Control Risk Assessment (ICRA) and UC Davis Health Construction Dust & Hazardous Materials Inspection Worksheet.

1. These documents dictate minimum requirements for Class I and II containments and minimum requirements that must be completed to control dust during construction.

a. 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.

B. 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.

C. 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 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. If visible mold is found 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.

D. 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. Disinfect Containment and Protection Areas as directed by University's Representative

E. 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.

F. 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 building including number of negative air units and sizes (cfm), and location of sealed blocked off areas of corridors. 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

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.

B. Review by PO&M HVAC staff for possibility to disconnect air supply and return into the project area. Negative air machines shall be connected to separate electrical circuits.

C. 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, and other openings within the area where contaminants can escape. Sealing the critical openings can be accomplished with tape, plastic, 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 four 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. **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.

3. **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.

4. 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 Permit Extension Form attached ~~provided~~ at the end of ~~in~~ this section.

PART II - PRODUCTS

2.01 MATERIALS

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

PART III - EXECUTION

3.01 CONTAINMENT CRITERIA

A. The outside of the work containment shall have present: ICRA Permit, Interim Life Safety Measure (ILSM) Permit, Daily ICRA Inspection Forms, manometer, entry warning sign, Containment Entry Log (provided by the **Contractor**) that lists all persons who enter the containment regardless of affiliation, including all University employees, an emergency telephone number of person to call 24 hours a day in the event of a negative pressure alarm or other issue, and that an Environment of Care Incident Report under the category of “Construction Dust” must be filed by area nursing management in case of constant or annoying alarms.

B. The interior of the containment area shall be cleaned on a continual basis daily. Hard surface floors in work area, adjacent hallways and passage areas require vacuuming with HEPA-filtered vacuum cleaners and frequent wet-mopping during demolition and construction; protect adjacent carpeted areas with plastic and plywood and vacuum with HEPA-filtered vacuum cleaners. Only an EPA Listed Germicide approved by the UC Davis Health Infection Prevention shall be used on the project site.

C. 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.

D. 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 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.

4. All polyethylene 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.

E. 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.

F. 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 are reviewed and approved by the University's Representative on a case by case basis.

G. 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.

H. 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.

3.02 NEGATIVE AIR CRITERIA

A. Under no circumstances shall the HEPA filtered air be discharged into existing HVAC returns, exhaust ducting or building plenum spaces.

B. 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.

C. 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.

D. 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.

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

F. 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.

3.03 NEGATIVE AIR MONITORING CRITERIA

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

1. Build containment with negative air machines capable of maintaining a pressure differential of -0.020 in-WC across all critical barriers

2. Demonstrate negative pressure is achieved continuously (24/7) by means of an electronic manometer sensitive to measure down to -0.020" wp. 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.

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.

C. Visual Verification

1. The containment shall be visually inspected to verify the plastic is bowed inward to the project area. Tell tail ribbon may also be used to confirm negative pressurization. Visual Verification of negative pressure without the use of a manometer shall be performed upon first entry to the work area, during the course of the work, especially if there are any changes to the work space that may change the negative pressure, prior to taking any breaks and at the end of the work period.

3.04 ADDITIONAL CONTAINMENT CRITERIA

A. Ante Room

1. An ante room is a separate chamber attached to the containment area with zippered doors to allow entry and exit into the containment area. Entry into the containment area shall be only via the ante room. The ante room is commonly constructed of zip poles or equivalent, plastic and tape. The ante room is sized for each project to allow workers and equipment to be moved into and out of the containment area. A sticky mat is required in the ante room for workers and carts on wheels to use when existing the ante room from the containment area. The zippered doors are to remain closed or adjusted slightly open as necessary to allow negative pressure to be maintained at least -0.020 in-WC.

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. The **Contractor** is responsible for removing a dirty sticky mat and replacing it with a clean one when it is necessary.

3. Workers 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.

2. Proper use of the disposable coveralls, booties and use of the sticky mat shall be followed at all times for all workers and UC Davis Health employees, when it is required by the ICRA Permit. At no time shall workers leave the containment area wearing disposable coveralls and booties. They are to be removed in the ante room or immediately in front of the ante room within the containment area if it is free and clean of debris. The workers shall remove all disposable coveralls and booties and place them in the plastic garbage bag and leave the ante room after walking on the sticky mat.

3.05 CONTAINMENT SET UP

A. Notify University's Representative forty-eight (48) hours prior to containment set up.

B. Build containment in compliance with ICRA, drawings and plans.

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

3.06 REMOVAL OF CONTAINMENT

A. Provide thorough cleaning of existing surfaces, which become exposed to dust, before leaving the containment area and before allowing staff and the public access to the project area.

B. Final cleaning of the containment area requires diligent HEPA vacuuming of all horizontal surfaces and wet wiping all surfaces. Clean towels, sponges, cloth rags or other means shall be used with clean water to effectively clean all surfaces within the containment area. Use of a measured solution of an EPA Listed Germicide is required as part of the final detail cleaning.

C. Additional HEPA filtered negative air units may be installed for scrubbing of particles (see 3.05 B).

D. 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.

E. 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.

3.07 ENTRY/EGRESS

A. Entry into the project containment area shall be through the ante room. Entry into the ante room requires one of the two zippered doors to be opened at one time to maintain the required negative pressure. After entering the ante room, the zipper shall be closed before leaving the ante room into the containment area. Equipment and supplies brought into the containment area shall be in sealed leak tight containers inside of rolling covered carts. Equipment, tools and supplies brought into the building shall be clean and free of dust, debris, mold and other contaminants. Cardboard products shall not be brought into the containment area if they are water damaged or have suspect mold growth.

B. All HEPA equipment when transported into and out of the containment area shall be cleaned of all debris on the surfaces and shall have the intake openings sealed with plastic and duct tape.

C. All workers leaving the containment area shall leave in clean clothes. At no time shall disposable coveralls or booties be worn when leaving the containment area through the anteroom into the public area. The workers shall clean all gross particulate debris from the coveralls using a HEPA filtered vacuum. Disposable coveralls can be taken off after gross debris has been removed from the disposable coveralls. The worker shall remove the disposable coverall inside of the 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.

3.08 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.

3.09 Refer to the following Attachments

A. Infection Control Risk Assessment (ICRA) with Matrix of Precautions for Construction & Renovation: 18 Pages.

B. UC Davis Health Construction Dust Infection Prevention Best Practice Standard: 18 Pages including.

1. Appendix A: Inspection Documentation Form and Daily Inspection Log.

2. Appendix B: Entry Warning Sign with Project Manager Contact.

END OF SECTION 01 56 10

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 that was included in the review of this packet and agree with the requirements identified within the packet.		
Department	Name	Email
UCDH Project Manager		
Fire Marshal's Office		
Infection Prevention		
Environmental Health & Safety		
Contractor Representative		
Other Multidisciplinary Team Members		

INFECTION CONTROL RISK ASSESSMENT

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

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 this Reasoning for this Assessment:

Step Two: Using the table below, identify the Patient Risk Group(s) that will be affected. If more than one risk group will be affected, select the higher risk group.			
Low Risk **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 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: Click or tap here to enter text.	☐ **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: Click or tap here to enter text. ☐ Other: Click or tap here to enter text.

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: Click or tap here to enter text.	☐ Restrict/shut down air handlers for the duration of 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: Click or tap here to enter text. ☐ Provide Safety Data Sheets to EH&S for other recommended actions ☐ Other: Click or tap here to enter text.

HAZARDOUS MATERIALS

A determination regarding the presence of hazardous materials in all UCDH buildings must be made before a project starts. This can be accomplished by existing surveys that identify the presence of hazardous materials or by hiring a consultant to perform a hazardous materials assessment of the areas that the project will impact. All impacted Hazardous Materials must be handled per the appropriate control measures.
Note: A Certified Asbestos Consultant must have conducted an asbestos survey before any demolition or renovation activity. There are no exceptions based on the date of construction or the facility's age.

ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS		
Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)?	☐ 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: Click or tap here to enter text.	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 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**
	Positive/negative pulldown

		Positive/negative pulldown

ICRA Permit Number	ICRA Class
23-00001	Choose an item.

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

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

INFECTION PREVENTION REQUIREMENTS - CLASS I	
Prior to and During Construction:	• Perform noninvasive work activity as to not block or interrupt patient care. • Perform noninvasive work activities in areas that are not directly occupied with patients. • Perform noninvasive work activity in a manner that does not create dust. • Immediately replace any displaced ceiling tile before leaving the area and/or at end of noninvasive 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 as well as air diffuser surfaces. HVAC Systems • Remove isolation of 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. • 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.

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.

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:

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

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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

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**'s proposal. The decision of University shall be final.

    d. University will accept, in writing, proposed substitutions that are in University's opinion equal in quality, utility and appearance to the product specified. Such acceptance does not relieve **Contractor** from complying with requirement of the Contract Documents.

e. **Contractor** shall be responsible for all costs of any changes resulting for **Contractor**'s proposed substitutions that affect other work, or the Work of Separate **Contractor**.

f. Failure to place orders for specified products sufficiently in advance of required date for incorporation into the Work will not be considered justification for **Contractor** to request a substitution or deviation from requirements of the Contract Documents. The sixty (60) calendar day submittal period does not excuse **Contractor** from completing the Work within the Contract Time.

2. **Contractor**'s Determination: Prior to submitting "or equal" product(s) for consideration, **Contractor** shall review and determine product(s) meet or exceed the quality and warranty provisions of the specified product.

3. Late Substitution Requests: If a request for substitution occurs after the sixty (60) calendar day period, the substitution may be reviewed at the discretion of University and the costs of such review, as approved by University, shall be deducted from the Contract Sum.

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#: _____ **HCAI#:** N/A

PROJECT NAME: MIND IT Network Modernization Building #25

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:

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:

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

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

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

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

1.07 APPLICATION FOR FINAL PAYMENT

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

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - PART III - EXECUTION

3.01 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use.

3.02 REPAIR PERIOD (GUARANTEE OR WARRANTY PERIOD)

A. Upon acceptance of the project or a portion thereof from the **Contractor**, the "Guarantee to Repair Period" of one year or more will begin as described in Article 9 of the General Conditions. The University Representative will become responsible for receiving notices of Defective Work from building occupants and securing **Contractor** compliance where applicable. The University Representative shall have prime responsibility for follow-up & monitoring of **Contractor** activities. (Refer to Article 12 of General Conditions).

1. If the **Contractor** must "Shut-down" the fire and security alarms in an occupied building, then the **Contractor** shall be responsible to provide a fire and security watch until the system, at no additional cost to the University.

END OF SECTION 01 77 00

SECTION 01 78 00

CLOSEOUT SUBMITTALS

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 Record 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 016100 – PRODUCT REQUIREMENTS

G. 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 PROJECT AS-BUILT RECORD DOCUMENTS

A. Maintenance of As-Built Documents and Samples:

1. Provide complete set of As-Built Drawings and Specifications, showing every change from original Contract set, including all Addenda, Change Order, job decisions, etc. PDFs for this purpose may be obtained from University's Representative.

2. Refer to Section 017700 CLOSEOUT PROCEDURES for additional requirements for As-Built Documents.

3. When work is complete and prior to final payment, submit one (1) complete set of all As-Built documents, marked to show any deviation from the original Contract set. These documents are to be an accurate description of all work as constructed.

4. As-Built Schedule: **Contractor** shall provide As-Built Schedule of construction activities. Schedule shall be in same format as specified in SECTION 013200 – CONTRACT SCHEDULES.

B. As-Built Drawings: Comply with the following:

1. Number of Copies: Submit one PDF file bookmarked and searchable of marked-up As-Builts.

a. Initial Submittal:

1) Submit PDF As-Built digital data files.

2) Submit digital data files per UC Davis Health Campus Design Guidelines.

3) University's Representative will indicate whether general scope of changes, additional information recorded, and quality of document are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of digital As-Built.

2) Submit digital data files per UC Davis Health Campus Design Guidelines.

3) Final submittals of all formats will include all documents whether changes were made or not.

C. As-Built Specifications: Submit one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

D. As-Built Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. When As-Built Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous As-Built Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

F. Submittals: At Contract closeout, deliver Record Documents and samples as required by SECTION 017700 – CLOSEOUT PROCEDURES.

1. Transmit with cover letter listing:

a. Date.

b. Project title and Project number.

c. **Contractor**'s name, address and telephone number.

d. Number and title of each Record Document.

e. Signature of **Contractor** or authorized representative.

1.11 AS-BUILT SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. Note related Change Orders, As-Built Product Data, and As-Built Drawings where applicable.

5. Format: Submit As-Built Specifications as annotated PDF electronic file.

1.12 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.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, As-Built Specifications, and As-Built Drawings where applicable.

4. Format: Submit As-Built 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.

1.13 AS-BUILT 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.

2. Note related Change Orders, As-Built Specifications, and As-Built Drawings where applicable.

3. 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.

4. Each Sample will be labeled with Manufacturer, Model, Product Number, CSI Section and UC Davis Health Project Name and Number.

1.14 MISCELLANEOUS AS-BUILT SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work.

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

1.15 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.

1.16 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 **12** 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**.

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

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.

PRODUCTS

2.01 TEST EQUIPMENT

A. The **Contractor s**hall supply all personnel and equipment for the demonstration and testing, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. **Contractor** supplied personnel must be competent with and knowledgeable of all project-specific systems, and automation hardware and software. All training documentation, O&Ms, and submittals shall be at the job site before functional testing commences.

B. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and control systems in Division 23.

C. Special equipment, tools and instruments (only available from vendor/Subs, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be provided by the **Contractor** and left on site, for the CxA to use during functional testing, seasonal testing, and deferred testing. The equipment, tools, and instruments will be returned to the vendor/Subs after successful conclusion of the commissioning effort.

D. The controls contractor shall provide the CxA with temporary software license to be loaded on the CxA's computer, and any necessary network connection cables, for accessing the direct digital control system field panels for system testing. The controls contractor shall also provide a palm device (if applicable) with attachments, software, and cables, to check setpoint values of terminal device controllers. The controls contractor shall provide the CxA with log on ID, password, and LAN IP connection criteria for remote connection to direct digital control system. All the software, cables, and modems provided to the CxA will be returned at the successful conclusion of the commissioning effort.

E. All testing equipment used by the contractors shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Document Specifications (Project Manual). If not otherwise noted, the following minimum requirements apply to test and measurement equipment: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.1°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART II - EXECUTION

3.01 AFTER AWARD OF CONTRACT

A. The **Contractor** shall identify the person on their staff who will serve as the Commissioning Coordinator (CC). This person shall be responsible for all startup and commissioning issues on the project. Specific duties are identified in Part 1 of this Section.

B. Within the first 30 calendar days of the project the **Contractor** shall meet with the University and the commissioning agent to discuss the process to be used on the project for managing communication to and from the Cx agent. This is to include the means for communication issues, commissioning reviews, processing submittals, RFIs, change orders, etc., meeting minutes, schedule information, Cx agent observations, and the action item lists. If a mutually agreeable process cannot be agreed upon, the Cx agent's process and software tools will be utilized.

C. Within the first 60 days of the project there will be a meeting of the GC, the Cx agent and the key subcontractor's personnel to review how the Cx process will be implemented on the project and how the communication and documentation requirements will be met. The subcontractors are expected to send the staff that will be participating in the start-up and commissioning meetings.

D. The **Contractor** will submit a schedule listing the key startup and Cx activities. The initial schedule can be general in nature. As the project progresses, the details on the schedule must be sufficient to list the activities of each **Contractor** for each phase of the project and what work must be accomplished before each listed task.

E. The **Contractor** is to identify the team members from each subcontractor who will be participating in the start-up and commissioning meetings. This list is to include the name and contact information for the subcontractor's commissioning coordinator.

F. The **Contractor** is to compile a listing of all factory tests that will take place prior to the start of the start-up and commissioning meetings. The consolidated list, along with an approximation of when they are expected to take place, shall be forwarded to the Cx agent.

3.02 Cx MEETINGS

A. Eight weeks prior to supplying potable water to the building or the permanent power, the Commissioning Coordinator (CC) will schedule the first start-up and commissioning meeting. The meetings will not be concurrent with the **Contractor's** MEP coordination meeting and are to be scheduled at a mutually agreeable time between the **Contractor**, the Cx agent, and the University.

B. The meetings will initially be held every second or third week as appropriate, and then increase in frequency to weekly as the bulk of the start-up and commissioning work is taking place.

C. During each meeting an updated start-up and commissioning schedule will be distributed. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.

D. During the meetings a consolidated training, O&M, and attic stock list drawn from the contract document requirements will be distributed. Decisions on the O&M review, when the training will take place, and how the stock will be turned over the University will be made based on this document. In addition to the hard copies distributed at the meeting, an electronic version shall be forwarded to the Cx agent and the University.

E. Minutes of the start-up and commissioning meetings will be generated and distributed by the Commissioning Coordinator (CC). The minutes are to incorporate findings from the Cx agent. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.

F. The updated FPTs will be provided to the **Contractor** by the Cx agent.

G. The **Contractor** and the subcontractors will be required to coordinate their activities, and work collaboratively, with the test and balance contractor hired by the University.

H. The **Contractor** will coordinate the schedules for two review meetings to be led by the Cx agent. The first will be a comprehensive test and balance review and needs to include the mechanical subcontractor's wet and dry side foreman. The second meeting will be a controls review. This meeting is to be attended by the controls subcontractor's lead on the project and the programmer. Each meeting is to last at least two hours.

3.03 FIELD START-UP AND TESTING

A. The dates for all field start-up activities shall be listed on the start-up and commissioning schedule.

B. The CxA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional checklists to be completed, during the startup process.

C. The TAB contractor submits their TAB plan, along with the TAB Plan Review Checklist, for approval by the CxA prior to starting TAB work.

D. In general, the checkout and performance verification proceeds from simple to complex, from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.

E. The CxA shall review shop drawings and material certifications, review of reports from independent testing agencies, independent on-site periodic construction observation and attendance of selected quality control-related meetings (e. g., Pre-installation Conferences).

F. Pre-Functional Test Phase:

1. The **Contractor** shall prepare the equipment and systems for start-up in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. Start-up shall be performed by the **Contractor**'s and/or manufacturer's start-up technicians in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. The **Contractor** shall test the systems to verify that they perform in accordance with the Contract Documents, including the commissioning FPT procedures.

2. The CxA will witness equipment start up and testing. The **Contractor** shall notify the CxA in writing at least fourteen (14) calendar days in advance of the start-up and testing dates so that the CxA can schedule attendance. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA. When scheduled start-up activities are not executed because of lack of preparation or coordination by the **Contractor**, the **Contractor** will be subject to back-charges in accordance with the Contract Documents.

3. The **Contractor** shall complete and compile all start-up forms, test forms and SRCs for the System Readiness Manual and submit to the CxA.

4. Upon receipt of the completed System Readiness Manual forms, the CxA will perform an Installation Verification by providing various inspections and back-checks of the completed System Readiness Manual forms. Issues notes during this process will be documented by the CxA in the Commissioning Issues Log.

5. Upon acceptance of the System Readiness Manual, which includes the draft TAB report, functional performance testing shall be scheduled. Functional performance testing shall not commence until all critical issues identified during the Installation Verification process are resolved.

G. Upon completion of the start-up and contractually required work, the **Contractor** shall submit a 'Ready to Commission' document to the University for the Specific Equipment and/or system that is complete. It is only after this document is received that the FPTs will commence.

3.04 Functional Performance Testing:

A. Functional Performance Testing of commissioned systems shall begin after all critical issues discovered during the installation verification process have been corrected.

B. The procedure for developing and performing the FPTs shall be as follows:

1. The **Contractor** shall provide the equipment and commissioning submittals as specified in the Contract Documents.

2. The Commissioning Authority will draft the FPT procedures based on the **Contractor**'s submittals as approved by the Design Team. The draft procedures will be submitted to the Commissioning Team for review.

3. Each **Contractor** and equipment supplier that is specified as an FPT participant in the FPT Summary Tables in the specifications shall participate in the development and performance of the associated FPTs. Each FPT participant shall provide written comments on the associated FPT procedures regarding each of the following issues:

    a. Verify that the procedures can be performed without compromising the safety of the participants

    b. Verify that the procedures can be performed without compromising the warranties of equipment, components, and systems

    c. Verify that the procedures are appropriate for the equipment, components and systems as provided

4. The CxA will complete the working drafts of the FPT procedures.

5. Subcontractors and suppliers shall provide the personnel, expertise and test equipment to operate and maintain the systems during testing.

6. The **Contractor** shall test all systems within the commissioning scope of work, using the FPT procedures until the acceptable results specified in the FPT procedure are verified and documented. If necessary to obtain acceptable results, the **Contractor** may consult with the CxA to acquire clarification and resolve issues. The CxA will be available for on-site assistance of this nature.

7. The **Contractor** shall submit documentation that verifies that the acceptable results specified in the FPT procedures have been verified and that they are ready to demonstrate the FPTs with acceptable results. Acceptable documentation consists of completed FPT record forms which document acceptable FPT results or indication on the Systems Readiness Checklists that the **Contractor**'s pre-functional testing has verified that functional performance testing of the equipment and associated system demonstrate the acceptable results as specified.

8. After the CxA has accepted the **Contractor**'s documentation of acceptable results, the FPT shall be conducted and demonstrated to the CxA. If acceptable results are not demonstrated for an FPT, the **Contractor** shall resolve the issue(s) and the demonstration shall be repeated.

9. The **Contractor** shall verify and document acceptable FPT results for all equipment components and systems. The FPTs may be demonstrated for a sample of the systems that comply with all of the following criteria. This process is referred to in this document as “demonstration sampling”.

    a. There shall be many of the systems with similar components that have identical sequences of operation which are implemented using identical control software programming.

    b. The components and systems to be included in the Demonstration Samples will be chosen by the CxA at the time of demonstration.

    c. The sample size will be in accordance with the Functional Performance Test (FPT) Demonstration Sampling Tables in the specifications.

    d. Acceptable results must be demonstrated for the entire sample. If the FPT results are not acceptable due to a lack of preparation or coordination by the **Contractor** for any system or component sampled, the FPT shall be demonstrated for all the systems and components for which it was written. Whenever the demonstrated results are not acceptable, the **Contractor** shall make corrections and the FPT shall be demonstrated again. The cost of back-checking FPTs with unacceptable results is not included in the Commissioning Authority’s scope of work. Back-charging applies to additional back-checking required due to lack of preparation by **Contractor**.

10. The CC is responsible for scheduling and coordinating functional testing activities. The **Contractor** shall demonstrate the FPTs after they have verified that performing the FPTs will yield the documented acceptable results. The **Contractor** is subject to back-charging, as specified herein, if acceptable results are not demonstrated because of work that should have been verified during pre-demonstration testing prior to the submittal of the System Readiness Manual. Acceptable results must be obtained during a single demonstration. No more than two delays of less than 15 minutes each are acceptable for each test.

    a. In addition to conducting the functional tests developed by the CxA, the **Contractor** shall be required to complete all start-up and testing procedures as specified elsewhere in the Contract Documents.

    b. Where the CxA requires BMS trending, the CxA will provide a points list within the FPT form that may include both hardware (input/output) and software (virtual) points and appropriate trending intervals.

11. The **Contractor** shall provide trend data to the CxA in electronic format. As a University approved alternative, the **Contractor** can provide the CxA remote access to the BMS and provide training that will allow the CxA to directly download trend data.

12. The CxA will analyze and review the trend data and associated system performance.

3.05 Cx AGENT Functional Performance Testing (FPT)

A. Upon receipt of the Ready to Cx statement, the Cx Agent will coordinate a time with the **Contractor** to witness the FPTs.

B. The CxA develops specific equipment and system functional performance test procedures. The **Contractor** and manufacturer review the procedures to make sure the tests are safe for the equipment provided.

C. The functional test procedures are executed by the **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 41 26

SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 SCHEDULING

A. Schedule work to coincide with new construction.

B. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.3 COORDINATION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Coordinate demolition work with Owner.

C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

D. Shut-down Periods:

1. Arrange timing of shut-down periods of in-service panels with Owner. Do not shut down any utility without prior written approval.
2. Keep shut-down period to minimum or use intermittent period as directed by Owner. Maintain life-safety systems in full operation in occupied facilities or provide notice minimum 3 days in advance.

E. Identify salvage items in cooperation with Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

C. Verify termination points for demolished services.

3.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

B. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Make temporary connections to maintain service in areas adjacent to work area.

C. Existing Telephone System: Maintain existing system in service.

D. Existing Public Address System: Maintain existing system in service. Disable system only to make switchovers and connections. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION

A. Demolition Drawings are based on field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.

B. Contractor shall visit project site and verify all conditions as they exist and shall remove, relocate and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all work with other trades.

C. Remove abandoned conduit, cabling, and associated supports, including abandoned conduit and cables above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces to match existing.

D. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

E. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

F. Remaining Circuits and Equipment: Reinstall existing electrical installations disturbed. Certain existing electrical installations may be located in walls, ceilings or floors that are to be removed and are essential for the operation of other remaining installations. Where this condition occurs provide a new extension of original circuits, raceways, equipment, and outlets to retain service continuity. Installations shall be concealed in finished areas.

G. Reconnect equipment being disturbed by renovation work and required for continuous service.

H. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit, and wiring which are not part of final project.

I. Install temporary wiring and connections to maintain existing systems in service during construction.

J. Perform work on energized equipment or circuits with experienced and trained personnel.

K. Remove, relocate, and extend existing installations to accommodate new construction.

L. Repair adjacent construction and finishes damaged during demolition and extension work.

M. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

N. Clean and repair existing equipment to remain or to be reinstalled.

O. Protect and retain power to existing active equipment remaining.

P. Cap abandoned empty conduit at both ends.

Q. If removed devices are on walls or ceilings that are to remain, blank cover plates are to be installed on outlet boxes.

3.4 EXISTING PANELBOARDS

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.

D. Remove existing wire no longer in use from panel to equipment.

E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS

A. Remove and protect items indicated on Drawings to be salvaged and turn over to Owner.

B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.

3.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

3.7 CLEANING

A. Remove demolished materials as work progresses. Legally dispose.

B. Keep workplace neat.

C. Clean and repair existing materials and equipment which remain or are to be reused.

D. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.8 RECYCLABLE AND REUSABLE MATERIAL AND EQUIPMENT:

A. Contractor shall be responsible for recycling of all removed materials and equipment as part of this work. Materials shall be collected by a recognized and approved reuse and recycling center.

B. Recyclable and reusable material and equipment shall include but not limited to the following:
   1. Plastic lighting diffusers
   2. Ferrous metals
   3. Non-ferrous metals
   4. Fluorescent lamps and ballasts

3.9 PROTECTION OF FINISHED WORK

A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior sealants (SLNT).

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.
   1. Submit Manufacturer's certifications that products comply with specified requirements and with local regulations for VOC content.

B. Color Samples:
   1. Samples for Initial Selection: Manufacturer's color charts consisting of actual strips of cured sealants showing the full range of colors available for each product exposed to view.
   2. Samples for Verification: For each kind and color of joint sealant selected, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Schedule: Cross-reference locations and applications of SLNT indicated on Drawings with products in Part 2 of this Section. Indicate proposed product, product type and color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Sample Warranties: For special warranties.

C. Quality Control Submittals:
   1. Product Test Reports: For each kind of joint sealant.
   2. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
   3. Statement of qualification for manufacturers and installers.
   4. Statement of compliance for compatibility of sealant with adjacent materials and coatings.
   5. Field-Adhesion-Test Reports: For each sealant application tested.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with record of successful in-service performance.

B. Provide materials for exterior envelope from a single manufacturer.

C. Compatibility: Verify compatibility of silicone sealant with materials in contact with sealant. Provide list of stone materials and verify that silicone sealant will not stain or damage stone work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi component materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

B. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

C. Compatibility and Adhesion Testing: Ascertain sealant compatibility and adhesion with adjacent materials using laboratory testing procedures.

PART 2 - PRODUCTS

2.1 SEALANT, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Sealant Colors: In accordance with approved sealant color schedule.
   1. Colors as selected by Architect from manufacturer's standard colors. Acceptance of sealant will depend on range of standard colors available for selection.
   2. Custom Color:

2.2 SILICONE SEALANT

A. (SLNT-8) Silicone Sealant, Mildew-Resistant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Products and Manufacturers:
      a. Dow Corning Corporation; Dow Corning 786.
      b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
      c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
      d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      e. Tremco Incorporated; Tremsil 200 White.
   2. Applications: Interior joints as follows:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Joints subject to water and high moisture areas.

2.3 ACRYLIC SEALANT

A. (SLNT-7) Acrylic Sealants: General purpose, paintable acrylic-emulsion sealant. Caulk with approximately 12-1/2 percent elongation complying with ASTM C834.

1. Products and Manufacturers:
   a. Tremco Incorporated: Acrylic Latex 834.
   b. Pecora Corporation: AC-20.
2. Location/Use:
   a. Joints in vertical surfaces and in horizontal surfaces not subject to traffic.
   b. Control and expansion joints on exposed interior surfaces of exterior walls.
   c. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
   d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
   e. Joints between plant-precast structural concrete units.
   f. Other joints as indicated.

B. Acoustic Joint Sealant: Refer to Section 092900 for acoustic sealant in gypsum board assemblies.

2.4 PREPARATORY MATERIALS

A. Joint Primer: Non-staining type recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive type recommended by sealant manufacturer; compatible with joint forming materials.

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

D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joint surfaces, backing, and anchorage of units forming sealant rabbet, and conditions under which sealant work is to be performed. Do not proceed with sealant work until unsatisfactory conditions have been corrected.

3.2 JOINT SURFACE PREPARATION

A. Preparation: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
   1. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
   2. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

B. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant.

C. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce dull sheen.

D. Ensure that joint forming materials are compatible with sealant.

E. Examine joint dimensions and size materials to achieve required width/depth ratios. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

3.3 SEALANT APPLICATION

A. Installation:
   1. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
   2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
   3. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   4. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

B. Apply sealant in accordance with manufacturer's printed instructions. Perform work in accordance with ASTM C804.

C. Prime or seal joint surfaces. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

D. Employ only proven installation techniques, which will ensure that sealant will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides.
   1. Except as otherwise indicated, fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between horizontal surface and vertical surface, fill joint to form slight cove, so that joint will not trap moisture and dirt.

E. Interior joints not subject to movement, these are:
   1. Gypsum board to masonry joints.
   2. Gypsum board to hollow metal joints.
   3. Gypsum board to concrete joints.

F. Do not allow sealant or compounds to overflow or flow onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough texture surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or sealant.

G. Remove excess and spillage of sealant promptly as work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

3.4 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from contact with contaminating operations or other causes so that they are without deterioration or damage at time of Substantial Completion.
   1. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

B. Clean off excess sealant or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

END OF SECTION

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SECTION 091330

CONCRETE SURFACE TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: surface-applied clear acrylic sealer for existing slabs or new slabs to be left exposed as finished floor.

1.2 ACTION SUBMITTALS

A. Product data: for each type of product indicated.

1.3 SITE CONDITIONS

A. Environmental limitations: comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting installation performance.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Compatibility: provide products that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer of chemicals based on testing and field experience.

2.2 ACRYLIC SEALER

A. Acrylic sealer: acrylic base clear sealing compound complying with astm c309 type 1, class a&b and containing not less than 30 percent solids, non-yellowing.
   1. Manufacturers and products:
      a. Dayton Superior Corp.: Safe Cure And Seal (J-19)
      b. Euclid Chemical Co.: Super-Diamond Clear Vox.
      c. L&M Construction Chemicals: Dress And Seal Wb 30

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine concrete slab for compliance with requirements, installation tolerances and other conditions affecting performance.
   1. Notify architect of conditions that would adversely affect installation or subsequent use.
   2. Repair or otherwise correct unsatisfactory conditions.
   3. Proceed with finishing procedures only after unsatisfactory conditions have been corrected. Proceeding with the work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Slab repair: employ same repair methods as demonstrated on mockup and approved by architect.Mix patching compound or grout material with dust created by grinding operations, manufacturer’s tint, or sand to match color of adjacent concrete surfaces.
   1. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
   2. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

B. Substrate Cleaning: Remove dirt, dust, rust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of floor finish system.
   1. Remove dirt, stains, measurement markings, oversprayed materials, tread marks and footprints that would remain visible in final Work.
   2. Verify that floor and joints are dry and free of debris and excessive dirt, dust, clay, sand and gravel

C. Adjacent Surfaces: Protect adjacent surfaces as required to prevent damage by finishing procedures.

3.3 SEALER APPLICATION

A. Apply concrete sealer in accordance with Manufacturer's requirements.

END OF SECTION

SECTION 092200

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Non-structural metal framing systems for interior assemblies, including:
   1. Interior partitions.
   2. Interior suspended ceiling and soffit systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each product, including installation accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design framing systems in accordance with American Iron and Steel Institute *AISI Standard S220-11 North American Specification for the Design of Cold-Formed Steel Framing - NonStructural Members*, except as otherwise shown or specified.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Provide framing type, weight, grade and finish of materials in accordance with Manufacturer's recommendations, except where otherwise required by governing regulations and applicable standards.
   2. Provide clips, fasteners, ties, reinforcing, flat strap and backing plates, stiffeners, shoes, tracks, hangers, brackets, anchors, accessories, and trim as recommended by Manufacturer for application indicated.
   3. Steel Sheet Components: ASTM C 645, fabricated of steel meeting requirements of ASTM A1003.
   4. Protective Coating (Minimum): ASTM A653, G40 hot-dip galvanized zinc coating or coating with G40 equivalent corrosion resistance.

B. (MET STUD-1) Metal Studs and Runners: ASTM C645, and meeting or exceeding flexural strength, allowable bending moment, and screw pull-out of a standard 33 mil thick stud. Equivalent studs are not permitted.

C. Double-Runners: ASTM C645 slip-type head joint; inside runner with 2-inch-deep flanges, and outer runner sized to friction fit inside runner.

D. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Furring and Bracing Members: Provide members with protective galvanized coating, in depths as indicated.
   1. (MET FURG-1) Hat-Shaped, Rigid Furring Channels: ASTM C645; with minimum base-metal thickness of 0.033 inch

2. (MET FURG-2) Z-Shaped Furring: With slotted or nonslotted web; with minimum base-metal thickness of 0.027 inch.
3. (MET FURG-3) Cold-Rolled Steel Channels: Channel bridging, furring channels, carrying channels, steel channel stiffeners and braces; with minimum base-metal thickness of 0.054 inch.

F. Galvanized Flat Strap and Backing Plate at Interior Stud Walls: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thicknesses:
   a. Typical: 0.054 inch.
   b. For Heavy Equipment and Grab Bar Locations: 0.068 inch.
2. Where Wood Backing and Blocking is Indicated: Refer to Section 061000 for wood requirements. Provide fire-resistant treatment.

2.3 SUSPENSION SYSTEMS

A. General: Comply with ASTM C754 for conditions indicated.

B. Metal Studs and Furring Channels: As specified above.

C. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper, 0.0625 inch diameter wire, or double strand of 0.0475 inch diameter wire.

D. Hanger Attachment to Anchors in Concrete: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by a qualified independent testing agency.
1. Postinstalled, chemical anchor.
2. Postinstalled, expansion anchor.

E. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162 inch diameter.

F. Manufactured Suspension Grid System for Ceilings and Soffits: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products and Manufacturers:
   a. Drywall Grid Systems by Armstrong World Industries, Inc..
   b. Drywall Grid Systems by Chicago Metallic Corporation.
   c. Drywall Suspension System by USG Corporation.

2.4 AUXILIARY MATERIALS

A. Fasteners: Galvanized steel fasteners of type, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates; and of length suitable for adequate penetration of substrate

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Installation Standards: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Install bracing at terminations in assemblies.

C. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

D. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from plane formed by faces of adjacent framing.

3.3 FRAMING INSTALLATION

A. Framing Installation, General:
   1. Partition Heights: Extend partition stud system through suspended ceilings to structural support above, except where indicated to terminate at ceiling.
      a. Provide additional bracing for partitions extending above ceiling where indicated.
      b. Continue framing around ducts penetrating partitions above ceiling.
   2. Coordinate erection of studs with installation of service utilities. Align stud web openings. Coordinate installation of bucks, anchors, blocking, electrical and mechanical work which is to be placed in or behind partition framing. Allow such items to be installed after framing is complete.
   3. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned joints to attain lateral support and avoid axial loading.
   4. Reinforce stud partitions and provide additional metal studs as indicated and required for installation of wall cabinets, wall mounted equipment, wall mounted mechanical and electrical fixtures, accessories, shelves and shelf standards. Provide thick steel plate to span minimum of 3 studs for installation of mirrors, toilet accessories or grab bars.

B. Runners and Tracks: Secure runner tracks to floor and ceiling construction, and to structure above ceilings as recommended by manufacturer, with fastener spacing not to exceed 24 inches o.c.
   1. Runner Tracks: Provide continuous track sized to match studs. Align runner tracks accurately to partition layout at both floor and ceiling. Provide fasteners at corners and ends of runner tracks.
   2. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   3. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

C. Metal Studs: Install studs vertically at 16 inches o.c., unless otherwise indicated, and not more than 2 inches from abutting construction, each side of openings, and at corners.
   1. Install metal studs in floor and ceiling runner tracks. Secure studs to runners. Anchor light gauge screw-type partition studs to runner tracks by screwing opposite flanges top and bottom, except screw end studs to both tracks at both flanges.
   2. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
   3. Provide additional studs at exterior corners and 2 inches from inside corners, terminations of partitions, and both sides of control joints.
   4. Where partitions abut other construction, provide vertical runner track securely attached to construction.

5. Use full length studs between runner tracks.
6. Stud Splicing: Not permitted.

D. Door Openings:
1. Frame door openings with vertical studs attached to each jamb of door frame.
2. Provide additional studs 2 inches from jamb studs.
3. Frame head of door with horizontal section of runner track attached to jamb studs and provide vertical studs cut to fit between head and ceiling tracks and attach to tracks.
4. Provide 3/4 inch cold-rolled steel channel stiffener at 6 inches above door head extending at least 2 stud spaces beyond jamb studs, and attach to studs.
5. Fit runners under and above openings, secure intermediate studs at spacing of wall studs. Brace stud framing system and make rigid.

E. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

F. Wall Furring Installation:
1. Erect wall furring directly attached to concrete block and concrete walls.
2. Erect furring channels horizontally or vertically as indicated. Secure in place on alternate channel flanges at maximum 24 inches on center.
3. Space furring channels maximum 24 inches on center, not more than 4 inches from floor and ceiling lines or abutting walls.
4. Erect freestanding metal stud framing by means of adjustable furring brackets in accordance with manufacturer's directions.
5. Splicing Members: Lap furring members 8 inches and runner channels 12 inches and wire-tie near each end of lap.

3.4 SUSPENSION SYSTEM INSTALLATION

A. Suspended Assemblies, General: ASTM C 754.
1. Install ceiling framing independent of walls, columns, and above ceiling work.
2. Do not bridge building expansion joints with support system.
3. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member transversely between parallel members.

B. Hangers: Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
1. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
a. Space hanger wires 48 inches o.c. along carrying channels and within 6 inches of ends of channel run. Anchor hanger wires to supporting structure. Do not attach hangers to metal deck tabs.
2. Coordinate location of hangers with other work.

C. Carrying Channels: Position channels at proper height and level, and secure with hanger wires.
1. Space main carrying channels at maximum 48 inches on center, not more than 6 inches from perimeter walls.
2. Lap splices minimum 12 inches and secure together 2 inches from each end of splice. Provide clearance between channels and abutting walls or partitions.

D. Furring Channels: Comply with Gypsum Association GA-203.
   1. Place furring channels perpendicular to carrying channels at 16 inches on center not more than 6 inches from perimeter walls.
   2. Lap splices minimum 8 inches and secure together one inch from each end of splice.
   3. Provide clearance between furring and abutting walls or partitions. Secure furring to carrying channels with clips.
   4. Frame both sides of joints with furring and other supports.

E. Manufactured Suspension Grid Systems: Install in accordance with Manufacturer's instructions.
   1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
   2. Install main beams and cross tees at the on center spacing required for ceiling loading, and location of in-ceiling services.
   3. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
   4. Provide additional bracing as required by code.

END OF SECTION

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SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Acoustic insulation and sealant.

1.2 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

PART 2 - PRODUCTS

2.1 GYPSUM PANEL PRODUCTS

A. Manufacturers:
   1. United States Gypsum.
   2. National Gypsum Company.
   3. Georgia-Pacific.
   4. CertainTeed Corporation.
   5. Temple-Inland.

B. Gypsum Board Products, General: In accordance with ASTM C 1396, and other specified requirements, and as follows:
   1. Provide products that do not contain asbestos.
   2. Provide products in accordance with recommendations of GA 216 - Application and Finishing of Gypsum Panel Products.
   3. Provide products in maximum lengths and widths available to minimize joints and to correspond with support system indicated.

C. (GYP BD-21) Gypsum Shaft Liner: One inch thick shaft wall liner panel with moisture resistant paper facing. Square edges designed for installation into I, C-H, E, or H metal studs.
   1. Acceptable Manufacturer, Paper Faced: ASTM C1396.
      a. United States Gypsum Company: SHEETROCK Brand Gypsum Liner Panels.
      b. National Gypsum Company: Gold Bond Brand Fire-Shield Shaftliner.
      c. G-P Gypsum Corp.: ToughRock Shaftliner.
   2. Acceptable Manufacturer, Moisture and Mold Resistant Paper Faced, ASTM D3273 score of 10:
      a. United States Gypsum Company: SHEETROCK Brand Mold Tough Gypsum Liner Panels.
      b. National Gypsum Company: Gold Bond Brand Fire-Shield Shaftliner XP.
      c. CertainTeed Corp.: M2Tech Shafliner Type X.
   3. Acceptable Manufacturer, Glass Mat Faced, ASTM C1658:
      a. CertainTeed Corp.: GlasRock Shaftliner Type X.
      b. G-P Gypsum Co.: DensGlass Shaftliner.
      c. National Gypsum Company: eXP Shaftliner.
      d. United States Gypsum Company: SHEETROCK Brand Glass-Mat Liner Panels.

2.2 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

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

2.3 ACCESSORIES

A. General: Provide auxiliary materials and accessories that comply with referenced installation standards and manufacturer's written instructions.

B. Trim Accessories: ASTM C 1047; galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet; in the following shapes as required:
   1. Cornerbead.
   2. LC-Bead: J-shaped; exposed long flange receives joint compound.
   3. L-Bead: L-shaped; exposed long flange receives joint compound.
   4. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   5. Expansion (control) joint.

C. Fasteners and Anchorages: GA 216, type and size as recommended by board manufacturer.

D. Fasteners: Use self-tapping or appropriate threaded fastener, compatible with all materials fasteners will contact with and not causing galvanic corrosion.

E. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

F. Joint Sealant (Non-Acoustic): As specified in Section 079200 - Joint Sealants.

G. (WRT) Wall Reveal Trim: Extruded Aluminum Profile Trim, Reveals, and Moldings.
   1. Material: Aluminum Alloy 6063-T5, ASTM B 221.
   2. Size: As indicated on Material Identification List.
   3. Finish: Prefinished or field-painted as indicated on Material Identification List.
   4. Manufacturers Subject to compliance with the requirements, provide products by one of the following:
      a. Gordon Incorporated.
      b. Fry Reglet Corporation.
      c. Pittcon Industries.

2.4 ACOUSTICAL INSULATION

A. Acoustic Insulation, General:
   1. Insulation is required to be formaldehyde-free or GreenGuard Indoor Air Quality Certified.
   2. Flamespread: Maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

B. (INSUL-40) Glass-Fiber Acoustic Insulation: ASTM C 665, Type I; unfaced fiberglass batts or blankets, free of formaldehyde and GreenGuard Indoor Air Quality Certified.
   1. Basis of Design:
      a. CertainTeed; NoiseReducer (FF)
      b. Johns Manville: Formaldehyde-Free and Unfaced Sound Control Batts.

2.5 ACOUSTICAL SEALANT

A. (SLNT) Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Provide permanently resilient, non-hardening, non-bleeding silicone or polyurethane caulking material. Use polyurethanes for joints that will be painted and silicone or polyurethane for unpainted joints. Do not use latex, siliconized latex, or siliconized acrylic sealants for acoustic purposes, unless the product is specifically listed below.
   2. Product Requirements:
      a. Elongation: 100 percent, minimum.
      b. Shore "A" Hardness: 45, maximum.
      c. Movement Capability: 30% or higher.
      d. Class: 35 or higher per ASTM C920.

B. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, non-hardening, non-skinning, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

PART 3 - EXECUTION

3.1 GYPSUM BOARD INSTALLATION

A. Install and finish gypsum board and accessories in accordance with manufacturer's printed instructions and comply with recommendations of GA 216 and ASTM C840, including appendixes. Verify control joint locations at walls and ceilings with Architect.

B. Minimize butt joints by using gypsum board of maximum length possible. If cut butt joints are unavoidable, locate end butt joints as far from center of walls or ceilings as possible and stagger not less than 12 inches in alternate courses of board.

C. Do not install imperfect, damaged, damp or wet gypsum board.

D. Abut boards together for light contact at edges or ends with not more than 1/16 inch open space between boards. Do not force into place.

E. Locate edges and joints over supports or back-blocking except in horizontal applications. Position gypsum board so that both tapered edge joints and cut edges abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partition/walls.
   1. Form curved surfaces by carefully bending and fastening board to smooth even curve, free of flat or distorted areas and other imperfections. Comply with manufacturer's instructions for dampening of sheets or scoring of back face, if required to form to radius shown.
   2. Hold gypsum board 1/4 inch above floor at each type of partition.

F. Isolate gypsum surfaces with control joints or other stress relief where:
   1. Partition or furring abuts structural element (except floor) or dissimilar wall or ceiling.
   2. Ceiling abuts structural element, dissimilar wall or partition or other vertical penetration.
   3. Construction changes within plane of partition or ceiling.
   4. Wings of "L", "U" and "T" shaped ceiling areas are joined.
   5. Expansion joints occur in exterior wall if expansion joints are not used.
   6. Where control joint is near a door opening, locate and align control joint with edge of door frame.
      a. Ceiling height door frames may be used as control joints.
      b. Where door frames are less than ceiling height, extend control joints to ceiling from both corners
   7. Review location of joints with Architect.

G. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft.in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

H. Provide perimeter isolation where non-load-bearing partitions abut structural decks or ceilings, or vertical structural elements. Allow not less than 1/4 inch, or more than 1/2 inch gap between gypsum and structure. Finish edges of face layer with casing bead. Seal space between casing bead and structure with continuous acoustical sealant bead. Do not attach board directly to tracks.

I. Cutting, Fitting and Trimming: Accurately measure and precut gypsum drywall units prior to installation. Make cuts from face side by scoring and snapping away from face side or by sawing. Completely cut paper on back face; do not break paper by tearing. Maintain close tolerances for accurate fit at joints between sheets and at framed openings, and allow for covering of edges of cut-outs with plates and escutcheons. Cut edges smooth as required for neat and accurate fit.

J. Begin fastening from center portion of sheet and work toward edges and ends. Ensure contact of drywall with supports by applying pressure on surface adjacent to fastener being driven. Do not locate fasteners closer than 3/8 inch from edges or ends of sheets. Drive with shank approximately perpendicular to drywall surface.

K. Drive screws with power screwdriver recommended by drywall manufacturer. Do not hammer drive screws. Set screw heads slightly below surface of drywall, but do not break or strip paper face around screw. Stagger screws on edges and ends of adjacent sheets.

3.2 ACCESSORIES INSTALLATION

A. Acoustical Insulation: Install blankets in accordance with manufacturer's printed instructions, with tight joints in blanket units. Use tape, adhesive or staples to hold blankets in place.
   1. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions and tight to items passing through partitions.

B. Drywall Sealant: Seal perimeter of sound-rated partitions by filling open space between drywall and floor or ceiling construction with continuous bead of sealant. Fill open spaces between drywall and fixtures, cabinets and other flush or penetrating items with continuous bead of sealant. Seal sides and back of electrical boxes to completely close up openings and joints. Seal perimeter of wallboard shaft wall where it abuts other work.
   1. Apply joint sealant in accordance with Section 079200 - Joint Sealants.

C. Reinforce external corners of drywall with metal corner bead. Securely fasten metal corner beads, edge trim casing beads and control joints.

3.3 FINISHING

A. Finish exposed drywall surfaces with joints, corners and exposed edges reinforced or trimmed and with joints, fastener heads, trim accessory flanges and surface defects filled with joint compound in accordance with drywall manufacturer's recommendations for smooth, flush surface. Form true, level or plumb lines, without joints, fastener heads, flanges of trim accessories or defects visible after application of field-applied decoration. Exposed metal trim (not filled) will not be acceptable.

B. Use joint tape to reinforce joints formed by tapered edges or butt ends of drywall units and at interior corners and angles. Set tape in joint compound and apply skim coat over tape in one application. Do not use topping or finishing compounds for setting of tapes.

C. Apply joint compound to joint. Apply joint compound to fill holes left from removal of screws at intermediate studs. Finish gypsum drywall thereafter, including sanding of final coat, in accordance with ASTM C840.

D. Where open spaces of more than 1/16 inch width occur between abutting drywall units, except at control joints, prefill joints with joint compound and allow prefill to dry before application of joint tape.

E. Finish Levels of Joints in Interior Gypsum Board Work:
   1. Level 0: No taping, finishing, or accessories required.

   a. Use above suspended ceilings and within other concealed spaces, unless assembly is fire rated, sound rated, sound or smoke controlled, or unless space serves as air plenum.
2. Level 1: At joints and interior angles embed tape in joint compound. Leave surface free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 2: At joints and interior angles embed tape in joint compound with one separate coat of joint compound applied over joints, angles, fastener heads, and accessories.
   a. Use for mold and water resistant gypsum board indicated for use as a substrate for ceramic tile.
   b. Use for gypsum board indicated for use as a substrate for wood paneling or acoustical panels.
   c. Use above suspended ceilings and within other concealed spaces if gypsum board assembly is fire rated, sound rated, sound or smoke controlled, or space serves as air plenum.
4. Level 3: At joints and interior angles embed tape in joint compound with 2 separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Apply joint compound smooth and free of tool marks and ridges.
   a. Use where heavy grade wall covering is final decoration.
   b. Use where gypsum board is base for acoustical ceiling tile.
5. Level 4: At joints and interior angles embed tape in joint compound with 3 separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Apply joint compound smooth and free of tool marks and ridges.
   a. Use for all locations, except those indicated for other finish levels.

3.4 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, verify installation of mechanical, electrical and other facility services work and Installation of ceiling support framing in areas to receive gypsum board ceilings.

3.5 INSTALLED WORK

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

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

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

END OF SECTION

SECTION 096500

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient accessories.

1.2 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation.

1.4 FIELD CONDITIONS

A. Deliver resilient flooring materials in manufacturer's protective packaging. Store and handle flooring with care to prevent damage.

B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor coverings during the following time periods:
   1. 72 hours before installation.
   2. During installation.
   3. 72 hours after installation.

PART 2 - PRODUCTS

2.1 RESILIENT PRODUCTS

A. Products, General:
   1. Single Source: Provide each type of resilient flooring produced by single manufacturer, single run.

2.2 VINYL FLOORING

A. (RB) Rubber Wall Base: ASTM F 1861, Type TS.
   1. Basis of Design: Match existing.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Skim Coat: Portland cement-based, trowel-applied skim coat intended for thin application over rough or abrasive surfaces to create a smooth prepared surface to receive resilient flooring.
   1. Extent: At stair treads and landings in P1, P2 and P3.
   2. Primer: As recommended by and manufactured by concrete topping Manufacturer.
   3. Aggregate: Well washed, graded, fine gravel or larger aggregate as recommended by Manufacturer.

C. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

D. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

E. Sealer and Wax: Type recommended by resilient flooring material manufacturer for material type and location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.

D. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 INSTALLED WORK

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

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SECTION 099000

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Painting and finishing of new and existing materials (PT)
   2. Preparation of surfaces for painting and finishing.
   3. Repainting and refinishing of existing surfaces as indicated and as specified in Division 1 - Cutting and Patching. Preparation of existing surfaces for repainting and refinishing.

1.2 ACTION SUBMITTALS

A. Product Data: For each paint system specified, all coats, including block fillers and primers.
   1. Submit Manufacturer's certifications that products comply with specified requirements and with local regulations for VOC content.

B. Samples: Submit three 4 inch by 6 inch samples of each specified finish to be reviewed for color and sheen. Architect reserves right to select color or finish from any manufacturer, herein specified, as necessary to achieve desired color or finish.

C. Product Schedule: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations and cross-reference each material by manufacturer’s catalog number and general classification.

1.3 QUALITY ASSURANCE

A. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

B. Applicator Qualifications: Engage experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with record of successful in-service performance.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 degrees F in well ventilated area. Restrict storage to paint materials and related equipment.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion. Comply with health and fire regulations.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer's recommendations as to environmental conditions under which painting and finishing can be applied. Do not apply finish in areas where dust is being generated.

B. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture contents of surfaces are below following maximums:
   1. Gypsum Wallboard: 12 percent.

C. Ensure surface temperature and surrounding air temperature is above 40 degrees F before applying finishes. Minimum application temperature for latex paints for interior work shall be 45 degrees F and 50 degrees F for exterior work. Minimum application temperature for transparent finish shall be 65 degrees F, or surface and air temperature shall be 5 degrees above dew point.

D. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes.

E. Provide minimum 25 foot candles of lighting on surfaces to be finished.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Manufacturers:
   1. Sherwin-Williams Company
   2. Benjamin Moore & Co.
   3. ICI Paints
   4. Mythic Paint
   5. PPG Industries
   6. Hirshfield’s Inc.
   7. Diamond Vogel Paints.
   8. Rust-Oleum.
   9. Valspar.

B. Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Single-Source Responsibility: Provide primers and undercoat coating produced by same manufacturer as finish coats. No Exceptions.

D. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

E. Painting and Finishing Schedules: Refer to Painting and Finishing Schedules in Part 3 of this Section.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
   2. Sheen: When one of following terms is used to denote specific sheen for coating listed, following index shall apply:
      a. Flat: Less than 15 units based on 85 degrees of sheen.
      b. Eggshell: 5 to 20 units based on 60 degrees of sheen.

c. Satin/Low Lustre: 15 to 35 units based on 60 degrees of sheen.
d. Semi-gloss: 30 to 65 units based on 60 degrees of sheen.
e. Gloss: Above 65 units based on 60 degrees of sheen.

F. (PT) Paint Colors: Provide specified color in paint type as scheduled in this Section
1. Colors: match existing.
2. Mixing and Tinting: Deliver paints ready-mixed to job site. Job mixing and job tinting is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive paint and transparent finishes for conditions that would adversely affect execution, permanence or quality of work and which cannot be put into acceptable condition through preparatory work. Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 PREPARATION OF SURFACES

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified, for each particular substrate condition.
1. Remove mildew, by scrubbing with solution of detergent, bleach and warm water. Rinse with clean water and allow surface to dry completely.
2. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect in writing of anticipated problems in using specified coating systems with substrate primed by others.

B. Remove hardware, hardware accessories, plates, lighting fixtures, and similar items in-place and not to be finish painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items by workmen skilled in trades involved.

C. Clean surfaces to be painted before applying paint or surface treatment. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program cleaning and painting so that dust and other contaminants from cleaning process will not fall in wet, newly painted surfaces.
1. Remove dirt, grease and oil from canvas and cotton insulated coverings.

D. Gypsum Wallboard: Remove contamination from gypsum wallboard surfaces and prime to show defects, if any. Paint after defects have been remedied.

E. Ferrous Metals: Clean non-galvanized, ferrous surfaces that have not been shop-coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with Steel Structures Painting Council (SSPC)-SP3.
1. Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent-clean, and touch-up with same primer as shop coat.
2. Clean unprimed steel surfaces by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
3. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime steel including shop primed steels.

F. Existing Surfaces to be Repainted or Refinished: Wash surfaces to remove grease, oil, soil or other matter which will interfere with proper bond of new materials. Scrape and wire brush loose or flaking paint. Fill cracks, voids or other defects.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials and transparent finish materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce mixture of uniform density, and as required during application of materials. Do not stir any film that may form on surface into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
   4. Apply each coat at proper consistency.
   5. Each coat of paint shall be slightly darker than preceding coat unless otherwise approved by Architect.
   6. Provide finish coats which are compatible with prime paints used.

B. Do not apply succeeding coats until previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce even, smooth surface in accordance with coating manufacturer's directions.
   1. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.

C. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive film thickness equivalent to that of flat surfaces.

D. Finish doors on tops, bottoms, and side edges same as exterior faces, unless otherwise indicated.

E. Film Thickness: Apply materials in accordance to paint manufacturer’s recommendations and spreading rates to provide total dry film thickness as recommended.
   1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated
   2. Use precision instruments designed for measuring and evaluation wet and dry films of paints and coatings.
   3. Results measuring less than recommended thickness will require additional material application.
   4. Use of poor hiding colors may require application of additional coats in order to achieve proper coverage and hiding.

F. Apply first-coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

G. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat.

H. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure finish coat with no burn-through or other defects due to insufficient sealing.

I. Painting and Repainting of Existing Surfaces: Where repainting of existing surfaces is required, repaint wall and ceiling surfaces in their entirety, patch or spot painting is not acceptable.

J. Paint surfaces behind movable equipment or furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to mechanical and electrical documents with respect to field painting and finishing requirements. Painting of mechanical and electrical work is not required in pipe chases, tunnels, and mechanical rooms with unpainted walls.

B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports, except where items are plated or covered with prefinished coating, or where they are not in finished space or room.

E. Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers before installation of equipment with 1 coat of flat black paint, to limit of sight line. Paint dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels.

F. Paint exposed piping, insulated piping and conduit occurring in finished areas. Color and texture to match adjacent surfaces.

G. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

3.6 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered. Touch up and restore damaged or defaced painted areas.

B. During progress of work keep premises free from unnecessary accumulation of tools, equipment, surplus materials and debris. Remove at end of each workday.

C. Upon completion of work clean window glass and other paint-spattered surfaces and leave premises neat and clean, to satisfaction of Architect.

3.7 PROTECTION

A. Adequately cover or otherwise protect finished work of other trades and other surfaces from paint and damage. Repair damage as result of inadequate or unsuitable protection as acceptable to Architect.
   1. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

B. Place cotton waste, cloths and material which may constitute fire hazard in closed metal containers and remove daily from site.

C. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items shall be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

D. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.8 INTERIOR PAINTING AND FINISHING SCHEDULE

A. Interior Ferrous and Non-Ferrous Metal Enamel:
   1. Surfaces Include: Hollow metal doors and frames.
   2. Water-Based Alkyd Urethane Enamel System:
      a. VOC Content:<50g/L
      b. Primer: Acrylic metal primer.
         1) 1 coat S-W Pro Industrial Pro-Cryl Universal Acrylic Metal Primer, B66-1300 Series.
      c. Finish: One of the following to match existing sheens.
         1) 2 coats S-W Pro Industrial Waterbased Alkyd Urethane Enamel Low Sheen (Eg-Shel), B53-2250 Series .
         2) 2 coats S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150/2150 Series

B. Gypsum Wallboard:
   1. Surfaces Included:
      a. Gypsum wallboard, including over skim coat of joint compound.
   2. Sheens, General: Unless noted otherwise on Room Finish Schedule.
      a. Walls: Eggshell
      b. Ceilings and Soffits: Flat
      c. Walls where indicated on Room Finish Schedule: Semi-gloss.
   3. Waterborne Zero-VOC, Low-Odor System: Zero-VOC, Low-Odor Acrylic Finish over Zero-VOC, Low-Odor Acrylic Primer - not more than 50 grams VOCs per liter, not less than 35 percent solids, ammonia free coating.
   4. Acrylic with Air Purify or Sanitizing Technology System:
      a. VOC Content: <50g/L
      b. Primer:
         1) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
      c. Finish: Water-based, premium quality acrylic latex with Air Purifying Technology,
         1) 2 coats S-W SuperPaint Air Purify Interior Latex Flat, A86-60 Series.
         2) 2 coats S-W SuperPaint Air Purify Interior Latex Satin, A87-60 Series.
         3) 2 coats S-W SuperPaint Air Purify Interior Latex Semi-Gloss, A88-60 Series.
         4) 2 coats S-W SuperPaint Interior Latex Satin with Sanitizing Technology

5. Zero VOC Vinyl Acrylic System:
   a. VOC Content: 0g/L
   b. Primer: Water-based vinyl acrylic primer and sealer.
      1) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
   c. Finish: Water-based acrylic, not less than 35 percent solids, ammonia free.
      1) 2 coats S-W ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
      2) 2 coats S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
      3) 2 coats S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series.
6. Water Based Polyamine Epoxy System:
   a. VOC Content: <50g/L
   b. Primer:
      1) 1 coat S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
      2) 2 coats S-W Pro Industrial Water Based Epoxy Eg-Shel, B73-300 Series.
      3) 2 coats S-W Pro Industrial Water Based Epoxy Gloss, B73-300 Series.

3.9 SPECIAL SURFACES

A. Black Enamel Finish:
   1. Surfaces Included: Duct throats for visible distance but not less than approximately 24 inches behind supply or return air grilles, registers, louvers.
      a. Wood blocking exposed at reveals.
   2. Water-Based Systems, Low-VOC: Acrylic Latex Finish.
      a. Finish: 1 coat S-W ProMar 400 Latex Flat Black, B30W400 Series.

3.10 REPAINTING OF EXISTING SURFACES

A. Existing Surfaces:
   1. Surfaces Included:
      a. Existing surfaces where indicated to be repainted.
   2. Low-VOC Latex System:
      a. Primer/Finish: 2 coats paint similar to type listed above.

3.11 SMOKE AND FIRE PARTITIONS

A. Stenciling: Smoke and Fire partitions shall be stenciled with the appropriate Hour-rating/Minute rating, i.e., "SMOKE and/or FIRE (1 HR /2 HR)," etc., above ceilings on both sides of walls in letters not less than 2-1/2 inches high.
   1. Stenciling shall be located above every door and no more than ten feet on center.
   2. Stencil every change in direction of rated walls.
   3. Indicate the end of a rated wall with a 2-inch vertical red line with an arrow pointing to the direction of the rated wall.

B. Latex System:
   1. Primer/Finish: Provide red semi-gloss paint. S-W 0 VOC Acrylic Semi-Gloss, B66-650 Series.

END OF SECTION

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SECTION 150100
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. 150500 – Basic Mechanical Materials and Methods

B. 150600 – Refrigerant Piping

C. 155000 – HVAC Piping Insulation

D. 157620 – Fan Coil units

E. 159600 – Energy Management Systems

F. 159900 – Testing Adjusting and Balancing

1.2 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 17
2. California Code of Regulations – Title 24 – Parts 2, 3, 4, 5, and 9
3. California Code of Regulations – Title 22 – Chapter 7
4. 2022 California Electric Code
5. National Fire Protection Association
6. Cal OSHA, Title 8 CCR or CA Labor Code
7. Occupational Safety and Health Administration
8. State Fire Marshal, Title 19 CCR
9. 2022 California Building Code
10. 2022 California Fire Code
11. 2022 California Mechanical Code
12. 2022 California Plumbing Code
13. AWWA 9th Edition
14. SMACNA Guidelines and Specifications
15. Other applicable state laws

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. When contract documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge.

E. No material installed as part of this Work shall contain asbestos in any form.

1.3 QUALITY ASSURANCE

A. Plumbers' Qualifications:

1. Plumbing: Certified in accordance with City of Sacramento, Chapter 9 of the Sacramento City Code, Article XXIV, Certification of Journey level Plumbers.

B. Show current certifications upon request.

C. Certification shall be copied and kept on file by Contractor for duration of the job and provided to University's Representative upon project completion.

1.4 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. The University will pay for all OSHPD permits, if applicable.

B. Arrange for utility connections. The University shall pay charges incurred, including excess service charges, if any.

1.5 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 to 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 extreme care in excavating near existing utilities to avoid any damage thereto. Contractor is responsible for any damage caused by Contractor's operations.

D. All material and equipment removed from site as part of this project is the property of the University unless specifically designated otherwise and shall be delivered to a location at the University as directed by the University's Representative.

1.6 PLACEMENT OF EQUIPMENT AND WORK

A. The placement of equipment and mechanical work in the locations and spaces shown on the Drawings is the Contractor's responsibility.

B. Move equipment and/or work into spaces through openings provided or located in the spaces during construction, as required.

Do disassembling and reassembling of equipment or other work necessary to accomplish this requirement without extra cost to the University.

1.7 MATERIAL LIST AND SUBSTITUTIONS

A. Comply with the requirements as stated in Specification Section 01330 and 01610. Partial or incomplete lists of material will not be considered.

B. Installation of reviewed substitution is Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost. Review by the University's Representative of the substituted equipment and/or dimensional Drawings does not waive these requirements.

1.8 EQUIPMENT DATA AND OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit equipment data and operation and maintenance instructions in accordance with Specification Section 01780, Closeout Submittal. Submit on all items for each and every system and piece of equipment furnished under these specifications. Equipment data to include full description of equipment, model number, serial number, nomenclature per Construction Documents, performance characteristics, performance curves and wiring diagrams. Best to include all information provided in the equipment submittal plus operation and maintenance instruction. Include copies of manufacturer’s Guarantee/Warranty.

B. Contractor shall start compiling the above data, including operating and maintenance instruction data, catalog cuts and diagrams from the equipment manufacturer so as not to delay Projection completion.

C. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

1. Mechanical Systems.

2. Plumbing Systems.
3. Piping Systems.
4. Provide performance curves, charts and diagrams were applicable.
5. Provide operating manual for all equipment listed in individual sections of the specification.

D. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments, belt and pulley sizes, etc.

E. Provide parts bulletins containing manufacturer's bulletins with part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

F. Post service telephone numbers and/or addresses in an appropriate place as designated by the University Representative.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. As mentioned herein or on Drawings, Contractor to provide each item listed of quality noted or equal. All material shall be new, full weight, standard in all respects, and in first-class condition. Provide materials of the same brand or manufacture throughout for each class of material or equipment wherever possible. Materials shall be tested within the Continental United States by independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements.

B. The trade names or catalog numbers stated herein indicates the grade or quality of materials desired.

C. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the University's Representative.

D. 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 should 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 University's Representative.

D. Welding materials and labor shall conform to ASME Code and applicable state labor regulations.

PART 3 - EXECUTION

3.1 DRAWINGS AND COORDINATION

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.

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. Verify all measurements at the building and be responsible for the correctness of it. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings.

D. In addition, obtain all necessary information from the other trades regarding centers of partitions, walls, location of plumbing mains, fire sprinkler mains, and electrical conduits, ducts, pipes, etc. in order that pipes, equipment, and ductwork may be placed in their correct positions.

E. 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 Contractor from furnishing it in place complete.

F. 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.

G. Furnish materials and work at proper time to avoid delay of the work.

H. The successful execution of this contract work includes compliance with two aspects of project quality assurance, installation quality control and system operational performance. In this scope of work, system operational performance focuses on the quality assurance of equipment, controls and systems. In addition to their own forces, Contractor will work with the test and balance and electrical testing agencies, respectively, to provide the University with documented evidence of commissioning/quality assurance for the mechanical and electrical portions of this project.

I. In addition to other requirements defined by the contract documents, or in the following paragraphs herein, the Contractor will be responsible for coordination and cooperation among the project team, inclusive of other subcontractors, and will provide trouble shooting of variances found to the intent of the design documents and provide execution of the resulting corrective measures. These efforts shall be expended at a minimum during the installation, the start up phase, the functional testing phase, and prior to system close out. All costs associated with the above, inclusive of re-testing of non-compliance items, shall be considered part of and included within the base contract amount.

J. Testing and balancing of the HVAC systems will be contracted directly by the University. The Contractor, however, will be required to coordinate with the designated test and balance contractor in all respects in a manner exactly as if he were a subcontractor. With the exception of the actual labor of the test and balance contractor, the contractor shall consider specification section 15990 – Plumbing/HVAC Final Testing, Adjusting, and Balancing, to be an inclusive part of his contract documents and shall assume necessary compliance therewith, especially substantial completion. The Contractor shall execute his work in close coordination with the test and balance contractor making every effort to provide complete test and balance systems, responding expeditiously to correct any deficiencies, inadequacies, imbalances, etc. that may be evidenced by the test to those systems. In that regard, cost and labor for the installation, addition, or removal of any shims, sheaves, or other similar items necessary for incremental adjustment of systems or equipment, in order to comply with the requirements to provide complete and balanced systems demonstrated by test and balance tests, will be considered to be part of the base scope of work of this project.

3.2 ACCESS

A. Continuously check 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 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 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 University's Representative. Contractor shall then

prepare necessary Drawings showing proposed changes. Submit proposed changes for review by the University's Representative prior to actual revision work in the field.

B. Two sets of Drawings showing all revisions shall be immediately presented to University's Representative for University 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 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 Contractor fails to coordinate at proper time or fails to locate items properly, resulting in extra work, then Contractor is responsible.

C. 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, ducts and conduits. Cut holes of the minimum dimension to suit size of pipe or duct installed and associated insulation.

3.6 ASBESTOS ABATEMENT

A. Existing systems within the area of this scope of work may have asbestos-bearing materials. Testing, encapsulation, removal, treatment, or correction of existing asbestos-bearing materials is not a part of this scope of work and is not the responsibility of the Contractor.

3.7 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 current Title 24, California Building Code requirements.

B. Provide all piping and ductwork with seismic restraints as called for in SMACNA's "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems".

C. In addition, conform to all State of California requirements.

3.8 DEMOLITION AND SALVAGE

A. All fixtures, materials, and equipment not designated for re-use or to be turned over to the University, shall be placed in recycle or waste bins as directed by the Owner’s Representative. No materials are to be removed from the project site without the express permission of the Owner’s Representative.

3.9 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. Comply with the requirements as stated in Specification Section 01310 for service shutdown procedures.

3.10 WARRANTIES AND GUARANTEES

A. Refer to Specification Section 01780 for requirements.

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.

C. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

3.11 PROJECT RECORD DOCUMENTS

A. Refer to Specification Section 01780 for requirements.

B. Match all symbols and designations used in contract Drawings when preparing "Record" Drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete marker at finished grade in manner suitable to University's Representative.

3.12 PROJECT COMPLETION TESTS AND START-UP

A. Upon completion of the mechanical work and completion of the BACS point by point verification, or at such time prior to completion as may be determined by the University's Representative, operate and test all mechanical equipment and systems for a period of at least five consecutive 24-hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Include operation of heating and air conditioning equipment and systems for a period of not less than five 24-hour days at not less than 90% of full specified heating and cooling capacities in tests. Commence tests after preliminary balancing and adjustments to the equipment and their areas served has been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the University's Representative at least seven calendar days in advance of starting the above tests.

B. The Contractor and BACS contractor/vendor will conduct two levels of Quality Assurance to verify that the required installation and performance of the Building Automation Control System as been met.
   1. Static Commissioning:
      a. A point-to-point examination and documentation of the successful installation of the BACS system and its components in its entirety.
      b. The start up of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the University.
   2. Dynamic Commissioning:
      a. A point-by-point demonstration and documentation of the successful performance of the BACS system and its components in its entirety.
      b. The verification demonstrations of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the University.

C. Provide training and orientation of University's operating staff in proper care and operation of equipment, systems and controls to University's Representative's satisfaction.

D. Neatly tabulate and deliver to the University's Representative complete operational data. Airflows, temperatures, fan speeds, motor currents, static pressures, and other similar data will be supplied by air balance contractor hired by the University.

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. All areas of building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

H. Final observation will not be made until all of the above have been completed and balance report has been submitted and reviewed.

I. Provide documentation of all tests as specified by this and other sections. Submit to the University's Representative in an electronic form (2 copies) and in hard paper form (2 copies). Compile the electronic copies (including graphics or drawings) entirely in the current version of Abode Acrobat 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) prior to both Project Close Out AND application for Final Payment. Successful Project Close Out requires receipt and approval of the test documentation.

3.13 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 University's Representative 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.

3.14 PRE-SEASON START UP

A. When requested by the University 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 University 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 University 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 (7) calendar days after notification, to begin test.

3.15 CLEAN UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, etc., and leave premises clean, neat, and orderly.

END OF SECTION 150100

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SECTION 150500
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Types of mechanical related work specified in this section include the following:
   1. Roof and Wall Flashing
   2. Pipe Identification
   3. Thermometers
   4. Gauges
   5. Belt Drives and Guards
   6. Electrical Motors and Motor Starters

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data in accordance with requirements of Specification Section 01330.

B. Equipment Data and Operation and Maintenance Instructions: Submit in accordance with Specification Division 1 and 150100 requirements.

PART 2 - PRODUCTS

2.1 FLASHINGS IN MEMBRANE TYPE ROOFING

A. 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.
   1. 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 above the flashing.
   2. Sewer vents and other piping extending through roof structure shall have flashing and counter flashings provided and installed as part of the roofing work. Contractor shall coordinate Work accordingly.

B. Sewer vents and other piping extending through roof structure shall not contain any lead materials and shall be Thaler, Smith, or equal, counter flashing sleeves installed as detailed.

2.2 THERMOMETERS

A. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type, Weston, Marshal Town, or equal. All thermometers shall be round, stainless steel case construction with glass front and shall be accurate within plus or minus one of the smallest scale divisions throughout the entire range. The thermometer scales shall have a minimum of 2º between graduations and a maximum of 20º between figures. 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. Each thermometer shall have ⅜” minimum IPS ball valve installed to isolate the thermometer or install thermometer in well.

B. Thermometers used for air temperature in ductwork, plenum boxes, etc., unless specified or shown otherwise, shall have a minimum scale face of 5” and shall have an adjustable mounting flange so that scale may be set at any angle up to 45º to facilitate reading.
   1. The thermometers shall have a perforated guard over stem suitable for sensing air temperature.
   2. Length of stem shall be a minimum of 8”.

C. Thermometer wells with chain and cap shall be provided where wells are indicated on the Drawings.

2.3 GAUGES

A. 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.

B. Gauges shall be of high quality, with accuracy to be within 1% in the middle third of the dial range and equipped with front calibration. Gauge movements shall be phosphor bronze, bushed, rotary type. Gauges mounted on panel boards shall be the flush-mounting type in cast-iron or aluminum cases. Stem or pipe mounted gauges shall have flangeless cases of drawn or stamped steel, phenolic, or aluminum. Gauges shall have a minimum dial size of 3-½". Gauges shall be installed with IPS ball valves ⅜" or larger S.O.V. for replacement or repair of gauge. Gauge to be installed with a pigtail to minimize gauge fluctuation.

2.4 PIPING AND EQUIPMENT IDENTIFICATION

A. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by means of colored stenciled legends and flow arrows, all as specified herein. The markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Label every 20' of actual length and in every room. At valve access doors or lift outs, identify piping and valves.

B. In lieu of the colored stenciling, prefabricated labels on paper or on pressure sensitive self-adhesive cloth tapes may be used, as manufactured by General Painting Company, Westline Products, or equal. The labels shall have black lettering and flow arrows on colored backgrounds, and the background colors shall conform to the color schedule shown in this Article. Yellow letters may be used on brown background only for better visibility. If the paper labels are used, they shall be attached to the piping with Arabol Adhesive No. E-3448, or equal. After the adhesive has dried, the paper label shall be given a protective coating of Arabol No. E708F, or equal.

1. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors are easily discernible.

C. Provide white lamacoid plate for each and every piece of equipment installed in this work. Lettering on plate shall be black, with size of lettering to suit equipment. Lettering shall be minimum of ⅜" in height. Plates shall be riveted or bolted to equipment.

D. At completion of project, Contractor shall submit a valve listing for all valves installed on the project. All valves shall be tagged with 2" diameter brass tags noting valve number and contents in the pipe. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted when valve is in the closed position. Separate lists shall be made for the plumbing and mechanical systems. Valve listing sheets shall be 8-½ x 11" installed in a frame with glass cover and suitable for hanging in an area selected by the University's Representative.

1. Provide Bakelite tags at areas where valves (equipment) are concealed above ceiling or behind access doors. Tags to describe concealed valves (equipment). Color code identification for plumbing shall be blue/HVAC-yellow/Electrical-green/Fire-red.

2.5 ELECTRIC MOTORS

A. Electric motors of more than ½ HP rating shall be, unless otherwise noted, ball-bearing, open (drip-proof), squirrel cage, induction type, normal starting torque, 3-phase, 60-cycle service, 40ºC continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Baldor, Century, or equal.

1. Motors located outdoors shall be TEFC type.

B. All motors of 1 HP and above shall be premium efficiency type, Century E-Plus, or equal, no known equal.

C. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on Drawings and shall have a 1.15 service factor.

D. For normal application, motors shall be furnished for normal starting torque duty. It shall be Contractor's responsibility, however, to provide motors and starters having suitable starting torque and current characteristics to allow starting (where starters are furnished under this section) the equipment within the branch circuit protection provided and within the overload protection required by codes.

E. Splash proof or totally enclosed motors having a continuous-duty temperature rise rating not exceeding 35ºC. shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

F. Shaft Grounding: VFD powered small AC motors (less than 300 hp) shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings. The shaft grounding system shall be CR Series as manufactured by Shaft Grounding Systems, Inc., or equal. The shaft grounding system shall reduce the shaft to frame voltage below 3 volts (as measured with Fluke 97 oscilloscope), have low drag, be field installable with hand held tools, sealed to be resistant to weather and contaminants and require no periodic adjustments or maintenance for a normal running life of five years at speed up to 1800 rpm. The grounding brush element must be changeable without shutting the motor down or using special tools. Isolated bearings are an acceptable alternate to shaft grounding.

2.6 ELECTRIC MOTOR STARTERS

A. If supplied, Contractor shall coordinate magnetic motor starters for equipment provided under the Mechanical Work such that they shall be furnished as part of the Mechanical Work and incorporated into the Electrical Work for installation, unless otherwise noted.

B. Unless otherwise noted, starters shall be furnished in NEMA 1 enclosure for inside installation and casketed NEMA 4 enclosure for outside installation, with three thermal overloads for three-phase motors and one overload element for single-phase motors. All overloads shall be ambient compensated.

C. Combination magnetic starters shall be GE or Square D with circuit breaker disconnects, trip size of breaker as required for motor size, or equal.

D. Magnetic motor starters shall be GE, Square D or equal.

E. Manual motor starters shall be GE or Square D, less enclosure, or equal.

F. Magnetic motor starters shall be provided with cover-mounted H.O.A. "OIL-TIGHT" type devices as scheduled and integral, fused, 120-volt, single-phase control transformers.

G. All starters shall be by same manufacturer, General Electric, Square D., or equal.

2.7 BELT DRIVES

A. Belt drives for fans and equipment shall consist of "V" belts and sheaves. No adjustable sheaves allowed.

B. Rating: Belt drives shall have a minimum horsepower rating, at designed speeds of 1.5 times the motor nameplate horsepower rating.

C. Construction: Sheaves shall be cast iron and shall be machined and balanced. Sheaves shall be keyed to the shaft and locked with Allen-type set screws.

D. Sheaves shall have pitch diameter of not less than the following sizes for the belt sections to be used.

1. *FHP - Section Belt 2.0” minimum P.D.
2. A - Section Belt 3.0” minimum P.D.
3. B - Section Belt 5.4” minimum P.D.
4. C - Section Belt 9.0” minimum P.D.
5. D - Section Belt 13.0” minimum P.D.

6. *Fractional Horsepower.

E. Belts shall be furnished in matched sets.

F. Fan Drives: Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost to the University.

1. Inlet vanes or variable pitch blades shall not be used to adjust air quantities at initial balance of the system.

2.8 GUARDS

A. Belt drives, gear drives, shafts, couplings, fan inlets, and running equipment shall be properly protected by guards, whether shown on the Drawings or not, all as required by local codes.

B. Construction: Belt guards shall be of all metal construction with angle iron framework. Guards for belt drives shall have a removable section held in place with studs and wing nuts for easy replacement of belts. Openings shall be provided at shaft ends for taking RPM readings. Belts shall be guarded on both sides of the drives.

C. Coupling guards shall be No. 10 gauge steel minimum.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION ANCHORS

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

B. Job testing: Load test 50% of the post-installed anchors on each job. See structural drawings for detailed information on testing and inspection of post-installed anchors.

3.2 INSTALLATION OF THERMOMETERS

A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb. Pipe sizes at the bulb shall be increased where necessary to allow for full flow without excessive resistance.

B. Where shown on the temperature control diagram, the Contractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers. Duct-mounted thermometers may be omitted at these locations.

C. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as specified below.

D.

Location	Range Degrees F
Air inlet and outlet of each Bank of heating and cooling coils.	30 to 120ºF
Adjacent to each insertion type thermostat installed (Hot Water) under "Temperature Control."	+50 to 250ºF
Thermometer bulb to be installed adjacent to bulb (Chilled Water) of insertion thermostat.	+30 to 130ºF
In supply and from tank and return of domestic hot water systems near circulating pump.	30 to 180ºF
In both the water inlet and water outlet of each bank of hot water and chilled water coils and heat exchangers.	+50 to 300ºF +25 to 125ºF (Chilled Water)

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 University's Representative.

E. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.3 INSTALLATION OF 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. Gauge Cocks and Siphons:
   1. A full port ball valve, or equal, no known equal, shall be supplied at each gauge and gauge connection.
      a. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.4 PIPE 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. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20-foot developed length intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the University's Representative to meet specific conditions.

D. 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.

E. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. The paint shall be prepared enamel brushed on or sprayed from pressurized cans.

H. Where the pipe marking colors are not easily visible over the background, such as brown on soil pipe, orange on copper pipe, or similar combinations, a neat white or aluminum-colored background shall be painted on the pipe before the markings are applied.

I. Label and tag valves and piping at access doors.

J. On medical gas, the oxygen piping will be labeled the entire length of the pipe in attics, walls, below floor, etc.

K. Color Coding: All medical oxygen piping shall be labeled every 10’ from one end to the other, this includes drops in walls that are sleeved, all overhead piping, etc. All painting shall consist of first quality products. Paint shall be W. P. Fuller, Devoe, or equal. Surface shall be thoroughly cleaned and dry. First coat shall be completely dry before applying second coat.

L. The sizes, in inches, of the stenciled lettering and flow arrows shall be as follows:

Outside Diameter, In Inches of Pipe or Covering	Size of Stencil Letter	Minimum Length of Flow Arrow
⅝" to 2" incl.	½"	2-½"
2-½" to 4" incl.	1"	4"
4-½" to 7" incl.	2"	5"
8" and larger	3"	6"

M. 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.

N. Markers shall be Brady "PIPE MARKERS" color code as per Pipe Markers self sticking Vinyl pipe markers.

Pipe Marking Schedule:

Legend	Color
Domestic Water	Green
Hot Water - Domestic Supply	Yellow
Hot Water - Domestic Return	Yellow

3.5 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 University.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical Work by the Temperature Control Subcontractor, 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.

1. 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.
2. Motors and VFDs furnished under Mechanical Work shall be installed under Electrical Work. Contractor to coordinate all motor starter and VFD requirements.
3. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the Temperature Control Contractor.
4. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aqua stats, and similar items, which are to be wired under the Electrical Work or by the Temperature Control Contractor, shall be installed under Mechanical Work.

C. 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.

D. 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 part of mechanical work and shall be of type specified in electrical specifications.

3.6 FLASHINGS

A. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped and sealed above flashing.

3.7 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to University's Representative. 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.

END OF SECTION 150500

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SECTION 150600
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigerant pipes and fittings.
   2. Refrigerant piping valves and specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty.

1.3 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A: Suction Lines for Air-Conditioning Applications at 300 psig. Suction Lines for Heat-Pump Applications at 535 psig. Hot-Gas and Liquid Lines at 535 psig.

2.2 REFRIGERANT PIPES AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR. Wrought-Copper Fittings and Unions: ASME B16.22.

B. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

C. Brazing Filler Metals: AWS A5.8/A5.8M.

D. Flexible Connectors: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket. Socket ends. Offset Performance capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly. Working Pressure Rating factory tested at minimum 500 psig. Maximum Operating Temperature at 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Service Valves: Forged brassbody with brass cap including key end to remove core. Removable ball-type check valve core with stainless-steel spring.

B. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

C. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

D. Thermostatic Expansion Valves: Comply with AHRI 750.

E. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

F. Straight-Type Strainers: Body to be Welded steel with corrosion-resistant coating. Screen to be 100-mesh stainless steel.

G. Moisture/Liquid Indicators: To be of forged brass with replaceable, clear, fused glass window with indicating element protected by filter screen.

H. Replaceable-Core Filter Dryers: Comply with AHRI 730.

I. Permanent Filter Dryers: Comply with AHRI 730.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators. Install valve so diaphragm case is warmer than bulb. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected: Solenoid valves, Thermostatic expansion valves, Hot-gas bypass valves or Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

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

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows: Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor. Install horizontal suction lines with a uniform slope downward to compressor. Install traps and double risers to entrain oil in vertical runs. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube." Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 FIELD QUALITY CONTROL

A. Provide finished test and inspection reports. With the following tests and inspections Complying with ASME B31.5, Chapter VI.: Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article. Fill system with nitrogen to the required test pressure. System shall maintain test pressure at the manifold gage throughout duration of test. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures: Install core in filter dryers after leak test but before evacuation. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions: Open shutoff valves in condenser water circuit. Verify that compressor oil level is correct. Open compressor suction and discharge valves. Open refrigerant valves except bypass valves that are used for other purposes. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 155000
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping above ground, indoors and outdoors.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. All products required shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. All products required shall not exceed the VOC limits allowed per current California Green Buildings Code.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: “Aeroflex USA, Inc.”, “Armacell LLC.”, “K-Flex USA.” or Equal.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness. Service Temperature Range: Minus 20 to plus 180 deg F.

2.5 SEALANTS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants: Permanently flexible, elastomeric sealant. Service Temperature Range: Minus 100 to plus 300 deg F.

C. Metal Jacket Flashing Sealants: Fire- and water-resistant, flexible, elastomeric sealant. Service Temperature Range: Minus 40 to plus 250 deg F.

D. ASJ Flashing and PVC Jacket Flashing Sealants: Materials shall be compatible with insulation materials, jackets, and substrates. Fire- and water-resistant, flexible, elastomeric sealant. Service Temperature Range: Minus 40 to plus 250 deg F.

2.6 FACTORY-APPLIED JACKETS

A. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.TAPES

D. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

E. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: “ITW Insulation Systems; Illinois Tool Works, Inc.”, “RPR Products, Inc.” or Equal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows: Draw jacket tight and smooth. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c. For below-ambient services, apply vapor-barrier mastic over staples. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following: Vibration-control devices, Testing agency labels and stamps, Nameplates and data plates, Manholes, Hand holes, and Cleanouts.

3.3 PENETRATIONS

A. Install insulation continuously through penetrations. Seal penetrations with flashing sealant. For applications requiring only indoor insulation, terminate insulation at penetration surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions as required to maintain UL listed assembly.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions: Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following: Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges: Install pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties: Install preformed valve covers manufactured of same material as pipe insulation when available. When preformed valve covers are not available,

install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. Install insulation to flanges as specified for flange insulation application. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

C. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following: Drainage piping located in crawl spaces. Underground piping. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR AND OUTDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

3.9 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Indoor Concealed: None.

D. Piping, Indoor Exposed: PVC or Aluminum.

E. Piping, Outdoor Concealed: PVC.

F. Piping, Outdoor Exposed: Aluminum.

3.10 FINISHES

A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Flat Acrylic Finis.: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

END OF SECTION 152500

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SECTION 157620
FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Fan coil units as indicated on the Drawings and as specified.

B. BACS interface according to other Division 15 Sections and the Drawings.

1.2 REQUIREMENTS OF THE FOLLOWING DIVISION 15 SECTIONS SHALL APPLY TO THIS SECTION.

A. Division 15, Section 150500 – BASIC MECHANICAL MATERIALS AND METHODS

1.3 QUALITY ASSURANCE

A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Store in clean dry place and protector from weather and construction traffic. Handle carefully to avoid damage to components, enclosures and finish.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 1.

B. Clearly define any exceptions to specifications and drawings.

C. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

D. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gages and finishes of materials.

E. Provide fan curves with specified operating point clearly plotted.

F. Submit sound power levels that are results of actual tests performed according to the AMCA 300-95 Standard. The sound data shall represent the actual mechanical design conditions and shall include the outlet and inlet sound power levels reported in the standard octave band frequency of 63Hz to 4000Hz. Sound ratings reported in terms of zones dBA units and sound pressure levels shall not be an acceptable substitution for the specified sound power levels.

G. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

H. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 016000 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test- run under observation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fan Coil Units (FCU) shall be type and size as indicated on the Drawings. Capacities shall be as indicated for the specified operating conditions.

1. Units to be of the single zone draw thru or blow thru horizontal configuration as indicated on the Drawings and Schedules. Units shall include fan sections, cooling coils and heating coils with matching sections, motors, drives, filter sections with filters, plenums, thermostats and other accessories as specified.
2. Motors
   a. Motors shall be open 1750 RPM mounted on an adjustable base. Voltage shall be as specified.
   b. Single-phase motors shall be of the sizes and voltages as specified with automatic overload and resilient mount.
   c. Polyphase motors may be supplied as required and may be rigid base.
   d. Permanent split-capacitor motor (MI-DD) are to be supplied as specified in performance schedules and will be supplied with solid state speed regulators.
3. All belt drives are to be V-belt type with cast iron sheaves. Fan coils 1200 CFM capacity and below can use three-speed direct drive fan motors.
4. Bearings shall be cast iron pillow-block-housed ball bearings, grease lubricated with relief plugs and lubricant fittings with oversized shafts, sized to operate at less than 75% of the first critical speed.
5. Casing shall be constructed of minimum 20 gauge steel with full top or bottom access available through removable aluminum panels. Side access will be available as required. Interior of unit shall be insulated with 1" fiberglass neoprene-coated NFPA-approved insulation secured with adhesive with exposed edges coated to resist erosion. Unit exterior shall be finished enamel.
6. Discharge and intake plenum sections shall be as indicated on the Drawings with motorized dampers where required.
7. Filters shall be of the size, type and arrangement as shown on the Drawings. Filter areas as specified are a minimum.
8. Coil section shall include a bright galvanized drain pan with ¾” drain connections under cooling coils and extended downstream to catch condensate carryover. Coils shall be completely encased in cabinet with no coil headers past outside dimensions of casing.
9. The fan section shall include DWDI forward curved wheels as scheduled with solid shaft, taperlock bushings and cast iron ball bearings. External vibration isolators are to be installed by the Contractor for each fan coil unit. Refer to Section 15240 for details of vibration hangers.
10. The coil section shall include a galvanized steel drain pan with ¾" drain connection under cooling coils and extended downstream to catch condensate carry over. Coils shall be completely encased in cabinet with no coil headers past outside dimension of casing. Coils shall have copper headers and shall be ARI certified. Coil areas scheduled are minimum.
11. Unit shall be furnished with a wall-mounted thermostat for field mounting by the manufacturer. The fan motor(s) shall be equipped with integral automatic temperature reset and motor current protection. The controller shall connect to the BACS for control and monitoring.
12. Combination motor starters shall be provided by this section where shown on the drawings and shall be specified according to the applicable section in Division 16.
13. VFDs shall be provided by this section where shown on the drawings and shall be specified according to the applicable section in Division 15.
14. Manufacturers: Trane, York, Carrier, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and opening dimensions are as instructed by the manufacturer.

B. Verify that required utilities are available, in proper location, and ready for use.

C. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Flexible duct connection shall be used at the inlet and outlet duct connections. The flexible duct connections shall be made from coated fabric. The clear space between connected parts shall be a minimum of 2” and the connection shall have 1” minimum slack material.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION 157620

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SECTION 159900
PLUMBING/HVAC FINAL TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Final test and balance of air distribution systems.

B. Final test and balance of hydronic distribution systems and associated equipment and apparatus of mechanical work.

C. Setting and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

D. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:

1. Piping systems
2. Terminal units
3. Balance Valves for Plumbing systems

1.2 QUALITY ASSURANCE

A. University's Representative shall hire independent testing agency services and facilities that specializes in testing, analysis, and balancing of hydronic systems and air distribution for heating-cooling systems. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating-cooling systems. Agency shall field test air and hydronic flows in accordance with methods set up by Associated Air Balance Council, National Standard Volume 1, latest edition.

B. Final testing and balancing of the HVAC systems will be contracted directly by the University. The mechanical contractor, however, will be required to coordinate with the designated test and balance contractor in all respects in a manner exactly as if he were a mechanical subcontractor. With the exception of the actual labor of the test and balance contractor, the mechanical contractor shall consider this specification section to be an inclusive part of his contract documents and shall assume necessary compliance therewith, especially substantial completion. The mechanical contractor shall execute his work in close coordination with the test and balance contractor making every effort to provide complete test and balance systems, responding expeditiously to correct any deficiencies, inadequacies, imbalances, etc. that may be evidenced by the test to those systems. In that regard, cost and labor for the installation, addition, or removal of any shims, sheaves, or other similar items necessary for incremental adjustment of systems or equipment, in order to comply with the requirements to provide complete and balanced systems demonstrated by test and balance tests, will be considered to be part of the base scope of work of this project.

1. Balancing air quantities of supply and exhaust including existing supply and return fans and all existing zone ducts to achieve those given on drawings. Records shall be kept on all air quantities measured, including tests prior to final balance. On systems with economy cycles, measure and record air quantity of supply and return fans with outside air dampers in minimum and maximum positions. Record variations in fan static and brake horsepower. Adjust to maintain constant building pressure.
2. The use of fire dampers as balancing dampers will not be permitted.
3. Primary air balance shall be achieved using variable fan speed, branch duct dampers, and so forth. The dampers on diffusers and registers may be used only for final balance.
4. Measure and record the ampere reading of each motor input after final adjustments have been made. Record nameplate amperage of motors.
5. Tabulate magnetic starter’s size, type and manufacturer with heater strip size, type and rating.

C. Reference Standards:
   1. AABC - Associated Air Balance Council - A National Standard Volume 1.
   2. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
   3. NEBB - National Environmental Balance Bureau.

1.3 SUBMITTALS

A. Provide submittals to indicate the extent of work proposed. Submit certified test reports as hereinafter specified signed by Test and Balance Supervisor who performed test and balance work. Provide all submittals in both hard copy and electronic format. Compile the electronic copies entirely in Abode Acrobat 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 CDs).

B. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

C. Provide submittal of completed balance report prior to request for final mechanical observation of the project.

1.4 JOB CONDITIONS

A. Balance agency shall perform the following during installation phase of systems:
   1. Study design specifications and engineering Drawings and prepare schedule to physically inspect mechanical equipment for hydronic and air distribution systems to be tested and balanced. Contractor shall provide balance agency with one copy of Contract Drawings and specifications, mechanical equipment submittals, and change orders necessary for proper balancing of air distribution systems.
   2. Balance agency shall make field inspections prior to closing in portions of systems to be balanced. Agency shall verify to its satisfaction that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that Agency will be able to properly balance system.
   3. Prepare final test and balancing schedule, test record forms, and necessary technical information about hydronic and air distribution systems for installed heating-cooling equipment.
   4. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
   1. At tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

A. Utilize test instruments and equipment for test and balance work required, of type, precision, and capacity as recommended in the following test and balance standards:
   1. Comply with AABC's Manual "AABC National Standards," Volume 1.

PART 3 - EXECUTION

3.1 BALANCING

A. Upon completion of hydronic and air handling systems, balance agency shall complete tests, analysis, and balance of hydronic and air handling systems for heating-cooling equipment.

B. This report shall include as minimum, but not be limited to, following design and actual information:
   1. Motors, Pumps, and Fans: Horsepower, brake horsepower, revolutions per minute, actual amperage, and full-load rated current.
   2. Pumps: Suction and discharge pressure.
   3. Coils: Gallons per minute, fluid temperature, and air temperature at outlet and inlet.
   4. All Rooms: Air temperature during test.
   5. Other information required to establish completely balanced systems.

3.2 BALANCE REQUIREMENTS

A. Make allowance for air filter resistance at time of tests. Balance main air supplies at design air quantities and at an air resistance across filter bank midway between design specifications for clean and dirty filters. Balance room air supply and exhaust to within 0 and plus 10% of design air quantities for rooms with an air supply, return, or exhaust under 1000 cfm and to within 0 and plus 5% in room where total is 1000 cfm or more, or in rooms with multiple outlets. In all cases, total air quantities supplied to any floor or major zone will be within 0 and plus 5% of design.

B. After final air and hydronic balance of systems, make adjustments to obtain uniform temperatures as required by actual occupancy.

C. Take static pressure readings with inclined manometer. Take air velocity readings with instruments of recent calibration. Take final velocity readings with Alnor Velometer, Anemotherm or Vane Type Anemometer, calibrated prior to test and recalibrated at end of test. Include certified correction curves for each calibration as part of record. Certify instruments accurate to standards currently used in common practice for system balance work. Use test cones for diffusers.

D. Run tests with supply, return, and exhaust systems operating and doors, windows, etc. closed or under regular traffic. If possible, make final readings with cooling coils under load to ensure that static pressures are at maximum.

E. Adjust deflection of supply outlets to ensure proper and uniform air distribution throughout area served by such outlets.

F. Work with temperature Control Subcontractor in adjustment of automatic dampers, valves, thermostats, etc. required to maintain proper temperatures in all portions of building.

G. Contractor responsible for installing heating, cooling, and ventilating equipment shall make any changes, additions, or modifications to dampers, fan drives and motor sheaves, pump impellers, motors, and other equipment necessary for proper air and hydronic balance.

H. Balance of systems shall be reviewed by University's Representative and during this review Mechanical Contractor shall furnish men, materials, ladders, etc. to enable University's Representative to take all readings as he may direct. If errors are found, Balancing Agency shall readjust system to satisfaction of University's Representative.

I. Return Air Shaft Test: Upon completion of construction of shafts to be used for return air, and after all pipe and duct penetrations are sealed, independent test and balance agency shall test shaft for leakage. Submit to Contractor a complete test report, and if required by results of this report, Contractor shall make repairs to shaft for the purpose of making it airtight. Upon completion of these repairs provide a retest and submit final report of results to University's Representative.

J. Seal shaft at openings, including openings into duct runs.

K. Provide test orifice and check an allowable loss of 250 C.F.M. at test pressure of 1-inch static pressure at each shaft.

L. Test equipment shall be capable of delivering minimum of 1500 C.F.M. and develop twice static pressure required in shaft.

M. Determine measured leakage factor by use of hook gauge with connections across installed orifice plate. Submit leakage factor determined by these tests to Contractor for correction.

N. Submit test equipment used to University's Representative for review before beginning work.

END OF SECTION 159900

SECTION 26 05 00

ELECTRICAL WORK – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONDITIONS

A. The Requirements of General Conditions and Special Conditions apply to Work of this Section as if fully repeated herein.

B. Drawings and specifications take precedence when they call for materials or construction methods of better quality or larger size than required by codes laws, rules, or regulations.

C. The Requirements of this Section apply to all Work of Division 26.

1.2 WORK INCLUDED

A. Provide a complete working installation with all material and equipment as shown and specified. The Contract Documents do not undertake to show or specify every item to be provided. When an item not shown or specified is necessary for proper operation of equipment shown or specified, provide the item, which will allow the system to function properly, at no increase in Contract Price.

B. Make electrical connections for equipment furnished as part of Work of other Sections.

C. Perform necessary equipment seismic anchorage in compliance with the California Building Code Title 24.

D. 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.

E. 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.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. As specified in Division 1 - General Requirements.
   2. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, or regulations.
   3. When the Contract Documents exceed requirements of applicable laws, ordinances, rules or regulations, Contract Documents shall take precedence.
   4. It is not the intent of the Contract Documents to repeat requirements of Codes except where necessary for completeness or clarity.
   5. All installed or connected equipment shall be labeled or certified for its use by a nationally recognized testing laboratory. Where equipment is not furnished with a factory installed label

or certification, it shall be the responsibility of the contractor to obtain and pay for the necessary tests and approvals.

1.4 SUBMITTALS

A. General:

1. Submit Shop Drawings and supplemental data for all materials and equipment specified in all Sections of this Division, in accordance with the Requirements of Division 1, and as specified hereinafter.
2. Submittals shall have materials proposed for the project identified. Catalog cuts containing unidentified materials or superfluous information will not be accepted.
3. All submittals shall be reviewed by the Contractor and stamped with his approval prior to submitting to the Architect. Contractor shall indicate in writing any deviation in submittals from requirement of Contract Documents.
4. Forward all submittals to the Architect, together, at one (1) time. Individual or incomplete submittals will not be acceptable. Only one (1) request for substitution will be considered on each item of materials or equipment.
5. Wherever catalog numbers and specific brands or trade names, not preceded by the designation "equal to", or followed by the designations "or equal", "or accepted equal", or "or approved equal", are mentioned in these Specifications or Drawings, no substitutions will be accepted.
6. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. The words "as specified" will not be sufficient identification.
7. Identify each submittal item by reference to Specification Section paragraph in which the item is specified or Drawing and Detail number.
8. Organize submittals in binders, in the same sequence as they appear in Specification Sections, article or paragraphs.
9. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weight. Reuse of the Contract Drawings as Shop Drawings will not be acceptable.
    a. Specifically show, by drawn detail or note, that equipment complies with each specified requirements of the Contract Documents.
    b. Drawings shall be to scale and dimensioned (except wiring diagrams need not be to scale) and may be prepared by a vendor but shall be submitted as instruments of Contractor, thoroughly checked, and stamped by Contractor before submission to Architect for review.
    c. Catalog cuts and published material may be included to supplement scale drawings.
10. Internal wiring diagrams of equipment shall show wiring as actually furnished for this project, with all optional items clearly identified as included or excluded. Clearly identify external wiring connections. Identify and obliterate superfluous material.
11. External system wiring diagrams shall show wiring as actually installed, connected, and identified for this project. Include identification of cables, cable conductors, terminals in terminal cabinets, and connections to the identified external wiring connection points on equipment. Prepare Drawings on twenty-four inches (24") by thirty-six inches (36") minimum sheets bearing title block of equipment manufacturer, manufacturer's local engineering distributor, or Contractor, prepared to accepted drafting standards, and bearing Contractor's approved stamp.
12. Acceptance of a substitute is not to be considered a release from the Specifications. Correct any deficiencies in an item, even though approved, at Contractor's expense.
13. Be responsible for installation of approved substitution. Make any changes required for installation of approved substituted equipment at no increase in Contract Sum.

B. Operating and Maintenance Instructions and Materials:
   1. After final completion and testing operations, part of the Work of this Division shall be responsibility for instructing the Owner's authorized representatives in operation, adjustment, and maintenance of electrical plant. Submit three (3) copies of certificate, signed by Owner's representatives, attesting to their having been instructed.
   2. Before Owner's personnel assume operation of systems, submit three (3) bound sets of Operating and Maintenance Instructions, Manuals, and Parts Lists on the electrical plant and its component parts, including all major equipment and that which requires or for which manufacturer recommends maintenance in a specified manner. Provide names, addresses and telephone numbers of source of supply for parts.

1.5 PROJECT RECORD DOCUMENTS

A. Upon completion of Work, furnish Architect with complete sets of reproducible plans upon which shall be shown all Work installed under Contract. Drawings shall include actual locations of outlets, conduit, and wire sizing as well as routing and revised panelboard schedules.

B. All symbols and designations used in preparing Record Drawings shall match those used in Contract Drawings.

C. Maintain an up to date set of electrical drawings during the course of construction.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Identify materials and equipment delivered to site to permit check against materials list and Shop Drawings.

B. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

1.7 PROJECT EXAMINATION AND CONDITIONS

A. Examine project; verify dimensions and locations against Drawings and become informed of all conditions under which Work is to be done before submitting proposals.

B. Information shown relative to services is based upon available records and data but shall be regarded as approximate only. Make deviations found necessary to conform with actual locations and conditions with no increase in Contract Sum. Verify locations and elevation of utilities prior to commencement of excavation for new underground installations.

C. Exercise extreme care in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations.

1.8 DRAWINGS AND COORDINATION WITH OTHER WORK

A. Drawings:
   1. For purposes of clarity and legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, special fittings, and the exact locations of items are not shown, unless specifically dimensioned.
   2. Exact routing of wiring and locations of outlets, panels, and other items, shall be governed by structural conditions, and materials and equipment already in place. Use data in the Contract Documents. In addition, the Architect reserves the right, at no increase in Contract Sum, to make any reasonable change in locations of exposed electrical items, to group them into

orderly relationships and/or increase their utility. Verify the Architect's requirements in this regard prior to roughing-in.

3. Dimensions, locations of doors, partitions and similar physical features shall be taken from Architectural Drawings and verified at the site as part of the Work of this Division. Consult the Architectural Drawings for exact location of outlets to center with architectural features, panels, and similar items, at the approximate locations shown on the Electrical Drawings.
4. Drawings indicate, generally, routes of all branch circuits. All runs to panels are indicated as starting from nearest outlet, pointing to direction of panel. Continue all such circuits, conduits to panel as though routes were indicated in their entirety.

B. Coordination:

1. Work out all "tight" conditions involving Work of this Division and Work of other Divisions in advance of installation. Provide additional Work necessary to overcome "tight" conditions, at no increase in Contract Sum.
2. Differences of disputes concerning coordination, interference or extent of Work between Divisions shall be decided by General Contractor. His decision, if consistent with Contract Document requirements, shall be final.
3. Provide adequate working space around electrical equipment in compliance with all applicable codes.
4. Coordinate electrical interface of mechanical equipment with the Work of Division 22 & 23.
5. Provide templates, information, and instructions for Work of other Divisions to properly locate holes and openings to be cut or provided for Electrical Work.
6. Size all feeders (conduit and wiring), motor starters, overload protection and circuit breakers to suit horsepower of motors or wattages of equipment furnished as part of the Work of the various Sections of the Specifications. In no case shall feeders and branch circuits (conduit and wiring) and circuit breakers be of smaller capacities or sizes than those shown or specified.
7. Schedule of Work - Refer to Section on Work Sequence.
8. Make every effort to keep existing electrical circuits, including telephone, public address, fire alarm, power, and other electrical services, in operation. Where power outages are unavoidable, schedule such outages with the Owner to occur at such times as to cause the least disruption of normal facility functions.

C. Equipment Rough-In:

1. Rough-in locations shown on Electrical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from the following sources:
   a. From Shop Drawings for Contractor-furnished and installed equipment.
   b. From the Architect for Owner-furnished, Contractor-installed equipment.
   c. From the Architect for existing equipment where such equipment is relocated as part of the Work of this Contract.
2. Verify electrical characteristics of equipment before starting rough-in.
3. Unless otherwise shown or specified, equipment which requires electrical connection shall be installed as part of the Work of the Division in which specified. Internal components shall be wired to a single point with wiring in raceway direct connection (hardwired) to building electrical system or internal wiring and connections with cord and plug for receptacle connection to building wiring.
4. Unless otherwise shown or specified, provide direct raceway and conductor connections from building wiring system to equipment terminals for direct connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished, and Contractor-installed, and for existing equipment relocated by the Contractor.
5. Insert plug in receptacle for cord-connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished, and Contractor-installed and for existing equipment

relocated by the Contractor. Provide new cord and plug if required on Owner-furnished and Contractor-installed equipment.

6. Provide disconnect switches, flush type in finished spaces, where shown or required by Codes for direct-connected equipment.
7. Disconnect existing equipment from building electrical system, including internal wiring required for relocation and reconnection at new location.

1.9 GUARANTEE

A. Provide guarantee in accordance with and in form required under Division 1. Repair or replace as may be necessary any defective work, material, or part with no increase in Contract Sum including repair or replacement of other Work, furnishing, equipment or premises caused by such repair or replacement of defective work.

1. Where other guarantee periods or requirements are called for in other sections of the contract documents, they shall take precedence over the requirements of Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Identify materials and equipment by manufacturer's name and nameplate data. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, and other components, listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. All materials shall be UL labeled and in accordance with NEMA Standards.

C. Where no specific make of material or equipment is mentioned, any high-quality product of a reputable manufacturer may be used, provided it conforms to requirements of system and meets with Architect's acceptance.

D. Conflicts between Plans and Specifications, exclusive of the General Conditions of the Contract, the most stringent and higher quality requirement shall govern.

E. If the Contract Documents are not complete as to any detail such as accessories or hardware, of a required construction system or with regard to manner of installing of parts, materials, or equipment, but there exists an accepted trade standard for good and workmanlike construction, such detail or accessories shall be deemed to have been implicitly required by the Contract Documents in accordance with such standard.

F. Equipment and material damaged during transportation, installation, or operation will be considered as totally damaged. Replace with new. Variance from this will be permitted only with written acceptance.

G. Provide an authorized representative to constantly supervise the Work of this Division and to check all materials prior to installation for conformance with the Contract Documents.

H. Do not use equipment exceeding dimensions indicated for equipment, or arrangements that reduce required clearances, or exceed specified maximum dimensions.

2.2 FLASH PROTECTION

A. Electrical equipment including switchboards, panelboards, disconnect switches, etc. which are likely to require examination, adjustment or servicing while energized shall be field marked to warn of potential electric arch flash hazards per CEC Article 110.16. Marking shall be a pre-printed label which references NFPA 70E.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer's Directions: Follow manufacturer's directions where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and level, neatly place support and anchor properly.

C. Assemble all equipment which requires assembling including Contractor-supplied bussing, internal wire connections where required; connect all incoming conduit, cable, and wires properly; and adjust and make ready for service electrical equipment and material required by this Contract.

D. All Work shall be done in orderly, workmanlike manner in accordance with NECA Standard of Installation and present neat appearing installation when completed.

E. Provide concrete pads for floor mounted electrical equipment.
1. Install minimum 4” high concrete pads, and a minimum of 2” beyond the equipment dimensions or as indicated. Other pad dimensions shall be as required to accommodate the equipment installed.
2. Use 3,000 PSI concrete.
3. Reinforce with 6” x 6” 10GA wire mesh with short dowels into floor at 12” on center around perimeter.
4. Chamfer top edges ¾.”
5. Make all faces smooth.
6. Set anchor bolts for equipment.
7. Coordinate the size of all pads and the location of all structural embedment requirements for anchor bolts and any vibration isolators.

3.2 NORMAL CONTINGENCIES

A. Protection: In performance of Work, protect existing facility and protect Work of other Sections as well as Work of this Section from damage.
1. Existing conduits which are required to be extended, altered, or reconnected shall be accomplished as shown or as directed. Existence of any wires, conduits, or other facilities are shown in a general way only. Determine existence, location, and condition on site.
2. Where existing conduits which are shown to be revised or which will be essential to functioning of particular system are cut or exposed due to construction changes, new connections shall be made in most expeditious manner as directed or shown. Where wiring is involved, new wires shall be "pulled-in" between nearest available accessible reused outlets. In all cases where new wires are required, shown, or specified to be installed in existing conduits, if same cannot be installed, new conduits shall be provided therefore as directed.
3. Existing switchboards, motor control centers, and panelboards which are required to be extended, altered, or modified under the Work of this Division shall be provided with new sections, bus extensions, and all necessary hardware for a complete and operating system.
4. Attention is called to the fact that all new conduit, wiring, and apparatus shown or specified shall be connected to existing systems so as to function as complete units.

5. All conduits, electrical apparatus, and similar items, in place and not shown or specified to be reused or which will not be essential to functioning of various systems when Work is completed, shall be removed. No existing material shall be reinstalled or reused, unless shown or specified. Concealed conduits which are not shown or specified to be reused and become exposed due to construction changes shall be removed to nearest available accessible reused outlets.

3.3 PERFORMANCE

A. Sleeves, Chases, and Concrete Inserts:
   1. This Division shall provide, to cause no delay, all required sleeves, chases, concrete inserts, anchor bolts, and similar items before concrete is placed, and be responsible for correct location and installation of same.
   2. Sleeves and chases are prohibited in structural members, except were shown or as otherwise approved in writing.

B. Cutting and Patching:
   1. Do all cutting and patching, including structural reinforcing, necessary for the Work of this Division.
   2. No reinforcing steel or pre-stressed tendons may be cut within concrete floors without prior approval. All new cores or drilled holes shall be a minimum of 1 ½” clear of existing reinforcing. Concrete slabs must be scanned to determine the location of all reinforcing steel prior to coring, anchorage, drilling, or any other modifications.
   3. Do no cutting or patching without prior approval. Repair damage done by cutting and patching equal to original condition, in Architect's opinion.

C. Provide metal backing plates, anchor plates, and similar items that are required for anchorage for the Work of this Section; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

3.4 TESTING AND ADJUSTING

A. Furnish all labor and test equipment required for the Work of this Division. Testing work is defined as that work necessary to establish that equipment has been properly assembled, connected, and checked to verify that intent and purpose of the drawings, specifications, manufacturer's instruction manuals, and directions of Architect have been accomplished in satisfactory manner.

B. Provide field tests to verify component compliance with Specifications, including but not limited to adjusting, calibrating, and setting circuit breakers, relays, timers, etc.

C. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions and show specified performance. If, in the opinion of the Architect, performance of equipment or systems is not in accordance with Contract Document or submitted data, alter, or replace equipment at no increase in Contract Sum.

D. Do not allow or cause any Work installed hereunder to be covered up or enclosed before it has been inspected and accepted. 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 condition in which it was found at time of cutting, all at no increase in Contract Sum.

E. At completion of Work provide written certification that all Systems are functioning properly without defects.

3.5 CLEANING AND PAINTING

A. Properly prepare Work of this Division to be finish painted as part of the Work of Painting Section.

B. Refinish Work supplied with final finish as part of the Work of this Division if damaged as part of the Work of this Division to satisfaction of Architect.

C. Thoroughly clean interiors of switchboards and motor control centers. After other Work is accomplished, clean exposed conduit, panels (interiors and exteriors), fixtures, and equipment, and leave in condition satisfactory to Architect.

D. Clean out and remove from site all surplus materials and debris resulting from this Work, including surplus excavated materials.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and SO cable with insulation rated 600 volts and less; and wiring connectors and connections.

B. Related Sections:
   1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. ANSI/NETA ATS – 2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems.

B. NECA (National Electrical Contractors Association) - Standard of Installation.

C. ANSI/NFPA 70 – National Electrical Code (NEC).

D. Part 3, Title 24, - California Electrical Code (CEC).

E. Underwriters Laboratories, Inc. (UL).
   1. UL-83, UL-44 – Thermoplastic-Insulated Wire and Cables.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Stranded conductor for feeders and branch circuits 10 AWG and smaller.
   2. Stranded conductors for control circuits.
   3. Conductor not smaller than 12 AWG for power and lighting circuits. The minimum size of emergency system conductors shall be 10 AWG.
   4. Conductor not smaller than 16 AWG for control circuits.
   5. 10 AWG conductors for 20 amperes, 120-volt branch circuit home runs longer than 75 feet.
   6. 10 AWG conductors for 20 amperes, 277-volt branch circuit home runs longer than 200 feet.
   7. Cables shall be jacketed 600 volts SO type.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
   2. Exposed Dry Interior Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
   3. Exterior Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.
   4. Underground Locations: Use only building wire Type THHN/THWN-2 or XHHW-2 insulation, in raceway.

5. Cord Drops: Use 600 volt ‘SO’ cable where indicated on drawings.

1.4 SUBMITTALS

A. Product Data: Submit for building wire and each cable type.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.8 COORDINATION

A. Where wire and cable destination are indicated and routing is not shown, determine routing and lengths required.

B. Determine required separation between wire, cable, and other work. Determine cable routing to avoid interference with other work.

C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
   1. Diamond Wire & Cable Co.
   2. Essex Group Inc.
   3. General Cable Co.
   4. Approved equal.

B. Product Description: Single conductor 600 volt insulated wire.

C. Conductor: Copper.

2.2 ELECTRICAL INSULATING TAPE:

A. Electrical insulating tape shall be 600-volt, flame retardant, cold and weather resistant, minimally .85 mil thick plastic vinyl material: Scotch No. 88, Tomic No. 85, Permacel No. 295, or equal.

2.3 INSULATING RESIN:

A. Use two-part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Scotchcast 3570G or equivalent.

2.4 REDUCING ADAPTERS:

A. Burndy, Thomas, and Betts or approved equal.

2.5 WIRING CONNECTORS

A. Bolted pressure connectors: Cast bronze compression bolts designed for parallel taps, tees, crosses, or end-to-end connections.

B. Insulated spring wire connectors (No. 10 AWG and smaller): multi-part construction incorporating a steel spring enclosed with a color-coded outer thermoplastic shell.

C. Insulated spring wire wet/damp location spring wire connectors: multi-part construction incorporating a steel spring enclosed with a color-coded outer thermoplastic shell pre-filled with silicone base to protect against moisture and corrosion.

D. Splices, taps and connectors (No. 8 AWG and larger): Burndy, T & B, or equal Tin-plated copper high-compression type lugs for installation with hand or hydraulically operated crimping tools and dies. Provide 2-hole lugs for size #4/0 AWG and larger wire where terminated to bus bars.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Splices in homerun conductors to panelboards, switchboards, switchgear, motor control centers, motor control enclosures, and other panels shall be kept to the minimum practicable and shall only be made as necessary to support pulling of the conductors. Make splices in conductors only within junction boxes, wiring troughs and other enclosures as permitted by the California Electrical Code.

D. Do not splice conductors in pull boxes, panelboards, switchboards, switchgear, motor control centers or motor control enclosures.

E. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

F. Special Techniques--Building Wire in Raceway:
   1. Pull conductors into raceway at same time.
   2. Install building wire 4 AWG and larger with pulling equipment.
   3. A maximum of three branch circuits are to be installed on any one conduit on 3 phase 4 wire system.
   4. Install a minimum of twelve inches of slack conductor at each outlet.

G. Special Techniques – SO Cable:
   1. Cable connectors shall be steel case liquid tight sized for the cable diameter and shall use strain relief gland fitting to prevent tension on conductor terminals.

H. Special Techniques - Wiring Connections:
   1. Clean conductor surfaces before installing lugs and connectors.
   2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
   3. Tape uninsulated conductors and connectors with electrical tape equal to the insulation of wire and with all irregular surfaces properly padded with “Scottify,” 2nd product or equal putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1 or equal.
   4. Install solderless tool applied pressure connectors and lugs for copper conductor splices and taps, 8 AWG and larger.
   5. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
   6. Splices in conductors installed below grades are not permitted, unless approved in writing by the University’s Representative.
   7. Outdoors or below grade, use wire connectors or compression type with heat shrink style watertight splice covers. Use Scotchcast 3570G resin epoxy to waterproof connections.
   8. Install waterproof wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller in outdoor or wet locations.
   9. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.

10. Secure conductors to circuit breakers, lugs and ground/neutral bus terminations utilizing a torque screwdriver or wrench to the manufacturer's specified torque values.

3.5 WIRE COLOR

A. General

1. Color code all conductors. Wire sizes #6 AWG and smaller shall have integral color-coded insulation. Wire sizes #4 AWG and larger may have black insulation but identified by color coded tape at all junctions, splice, pull or termination points. Tape shall be applied ½ lap to at least 6 inches of conductor. Color code wires as follows:

Conductors	120/209 Volts	277/480 Volts
Phase A	Black	Brown
Phase B	Red	Violet
Phase C	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

B. Branch Circuits: Shared neutral conductors for multiple circuits are not permitted. Provide a separate neutral conductor for each phase conductor.

C. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

D. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

E. Feeder Circuit Conductors: Uniquely color code each phase.

3.6 CONTROL, COMMUNICATION AND SIGNAL CONDUCTORS

A. Install in separate raceway systems from electrical line voltage wiring.

3.7 FIELD QUALITY CONTROL

A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.3.2.A.

B. Subject cables sized #2 AWG and larger, rated 600 volts AC to insulation resistance test per NETA ATS 7.3.2 B.2. Make tests and record insulation resistance with circuits isolated from source and load.

C. Do not megger any cables after connecting to any equipment, unless specifically directed to do so by Architect.

D. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Architect.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wire.
   2. Mechanical connectors.
   3. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
   1. ANSI/NETA ATS – 2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems.

C. Part 3, Title 24, - California Electrical Code (CEC).

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Existing Metal underground water pipe.
   2. Metal building frame.

B. All panelboards, junction boxes, pull boxes, wireways, device boxes, and equipment enclosures shall be bonded to the separate green equipment grounding conductor.

1.4 SECONDARY GROUNDING SYSTEM

A. The grounding system shall be provided as shown and shall meet the requirements of CEC Article 250.

B. In addition to the major components shown and required by Article 250, the grounding system shall include all fittings, connectors, devices, and material necessary for a complete and useable system.

C. Bond the grounding system to existing building columns.

1.5 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 WIRE

A. Grounding Electrode Conductor: Copper conductor insulated if in conduit or above grade exposed, bare if direct buried.

B. Bonding Conductor: Stranded copper with dual rated THHN/THWN insulation, color identified green. Where continuous color-coded conductors are not commercially available, provide a minimum 4” long color band with green, non-aging, plastic tape in accordance with the CEC.

2.2 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for installation.

2.3 CONNECTIONS

A. Provide high pressure compression type or exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.
   1. Exothermic welds shall be used for cable to cable and cable and for cable to structural steel surfaces.
   2. Pressure indented copper cable terminal, one hole with one inch galvanized or cadmium plated steel machine bolts and beveled washer each side shall be used for cable-to- ground bar and cable-to-equipment connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils and surface contaminants at connection points.

3.3 EXISTING WORK

A. Extend existing grounding system using materials and methods as specified.

3.4 GROUNDING ELECTRODE SYSTEM

A. Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.

B. Install grounding and bonding conductors concealed from view.

3.5 POWER SYSTEM GROUNDING

A. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in new telecom rooms. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:

1. Bonding conductor to building structural steel.

3.6 EQUIPMENT GROUNDING

A. Equipment Grounding Conductor: Provide a CEC sized insulated copper ground conductor in all 120VAC through 600 VAC feeder and branch circuit distribution conduits and cables.

B. Provide a separate grounding bus at panelboards, switchboards, motor control centers. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35 volts above ground.

C. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.

D. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold water piping system.

E. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.

F. Provide external ground wire wrapped around flexible conduit and terminate to connectors designed for the purpose.

G. Install continuous grounding using underground cold-water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

H. Permanently ground entire light and power system in accordance with CEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with CEC or as indicated on drawings.

J. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of

receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.

K. Ground conduits as necessary by means of grounding bushings on terminations at panelboards and switchboards to grounding bus.

L. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.7 SEPARATELY DERIVED ELECTRICAL SYSTEM GROUNDING

A. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.

B. Transformers: Provide a dual rated four or six-barrel grounding lug with a 5/8"-11 threaded hole. Drill enclosure with 11/16" bit and attach lug to enclosure utilizing a torque bolt and a dragon tooth transition washer or equal. Connect the following when present:

1. Building steel.

3.8 FIELD QUALITY CONTROL

A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.13.A.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit and cable tray supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Floor and wall mounted equipment base and support.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. Part 3, Title 24, - California Electrical Code (CEC).]

C. Underwriters Laboratories Inc.:

1. UL 1479 - Fire Tests of Through-Penetration Firestops.
2. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: UL 1479, to achieve fire ratings in accordance with UL Design Numbers noted on Drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Penetrations: Provide through-penetration firestop systems that are installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.

1. Install complete through penetration firestop systems that have been tested and are listed by recognized testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of site conditions.
2. F-Rated Systems: Install through-penetration firestop systems with F-ratings indicated, as

determined per ASTM E 814 or UL 1479, but not less than the fire resistance rating of the assembly being penetrated.

3. T-Rated Systems: Install through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.

B. Support systems shall be adequate for weight of equipment and raceways, including wiring which they carry.

1.6 SUBMITTALS

A. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance, and limitation criteria.

B. Design Data: Indicate load carrying capacity of hangers and supports.

C. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 SEISMIC DETAILS AND CALCULATIONS

A. Submit details and calculations for support and anchors that are not specifically detailed on the Drawings where required by California Building Standards Code, California Code of Regulations, Title 24. Pre-approved systems may be used as noted below only if the pre-approval is current and accepted by the local agency having jurisdiction.

1.8 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with

minimum three years experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Steel or Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Product Description: 1 5/8 inches square Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Spring steel conduit hanger to threaded rod.

2.4 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:
   1. Furnish UL listed products.
   2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide expansion anchors.
   2. Steel Structural Elements: Provide beam clamps.
   3. Concrete Surfaces: Provide expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide structural backing plate.
   5. Solid Masonry Walls: Provide expansion anchors.
   6. Sheet Metal: Provide sheet metal screws.
   7. Wood Elements: Provide wood screws.

B. Install conduit and raceway support and spacing in accordance with the California Electrical Code.

C. Install all support devices according to manufacturer’s guidelines and recommendations.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Do not drill through structural framing members.

F. Do not support equipment or fixtures from the roof deck. Provide necessary framing and joist hangers to span between structural members to locate hangers properly.

G. Install multiple conduits runs on common hangers.

H. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
   4. Support vertical conduit at every floor.
   5. Clip type hangers may be used in concealed areas on individual conduit runs.
   6. Group mounted, exposed, or concealed raceways shall be supported by trapeze hangers constructed of formed steel channels and treaded rods.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items, requiring firestopping.

B. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

C. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Pack voids with backing material.
      c. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

D. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Install type of firestopping material recommended by manufacturer.
   2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk.

G. Install chrome plated steel escutcheons at finished surfaces where penetrations occur below finished ceilings.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 26 05 53 - Identification for Electrical Systems.
4. Section 26 27 16 - Electrical Cabinets and Enclosures.
5. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. Part 3, Title 24, - California Electrical Code (CEC).

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size:
1. 3/4 inch.
2. 1 inch outside foundation line.

1.5 SUBMITTALS

A. Product Data: Submit for the following:

1. Metallic conduit.
2. Electrical metallic tubing.
3. Flexible metal conduit.
4. Liquid tight flexible metal conduit.
5. Nonmetallic conduit.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

C. Provide Seismic Shop Drawings from a structural engineer licensed in the state of California for any conduit support systems containing conduits 2.5” or larger in trade size or assemblies weighing over 10 lbs. per linear foot which are suspended further than 12” from the point attachment to the building structure to the top of the conduit or trapeze support systems.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Record actual routing of conduits larger than 2 inches.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.8 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

B. Coordinate Work of this Division and Work of other Divisions in advance of installation. Provide additional Work to overcome tight conditions at no increase in Contract Sum.

C. Coordinate installation of outlet boxes for equipment specified in other divisions.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings: NEMA FB 1. Fittings shall be steel with threaded fittings. Use insulated metallic bushings with lug where ground connections are required. Use plastic bushing for non-bonding applications.

D. Conduit Bodies: Bodies connected to rigid steel or intermediate conduit shall be the cast iron. Provide matching gasketed stainless steel cover with at least two corrosion resistant screws. Die cast aluminum products are not permitted.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1; Fittings shall be steel insulated throat type rated as suitable for system ground continuity.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket. Minimum size shall be ¾."

B. Fittings: NEMA FB 1; fittings shall be liquid tight with watertight connectors when installed in damp or wet locations.

C. Connectors for liquid tight flexible conduit shall be screw-in ground cone type.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings: NEMA FB 1; steel compression concrete tight couplings and connectors. Fittings shall meet same requirements for finish and material as EMT conduit. Box connectors shall have nylon insulated throat. Set screw type couplings are not permitted.

C. Fittings shall be assembled with anti-corrosion, conductive anti-seize compound at joints made tight to exclude water.

D. Conduit Bodies: Bodies shall be the cast iron. Provide matching gasketed stainless steel cover with at least two corrosion resistant screws. Die cast aluminum products are not permitted.

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC.

B. Fittings: NEMA TC 3.

C. Non-metallic conduit fittings shall be of the same material as the conduit furnished and be the product of the same manufacturer.

D. PVC 90-degree bends shall not be used. Wrapped rigid conduit will be used in its place. Double lap of Calpico 10 mil or approved equal.

2.7 WEATHERPROOF CABLE TERMINATERS

A. Product Description: Dust tight and liquid tight with sealing ring and insulated throat.

B. Bushing shall be OZ/Gedney type KR or equal.

2.8 EXPANSION AND DEFLECTION FITTINGS

A. OZ/Gedney type DX or equal.

2.9 SURFACE METAL RACEWAY

A. Manufacturers:
   1. The Wiremold Co. Series 2000, 3000 4000, &6000.
   2. Approved equal.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. Wireway systems smaller than Wiremold series 700, or equal are notpermitted.

D. Finish: Gray enamel.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.10 WIREWAY

A. Product Description: Steel, general purpose or Raintight type wireway.

B. Finish: Rust inhibiting primer coating with gray enamel finish.

C. Wireway systems shall have dividers between line voltage and low voltage systems.

2.11 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2-inch male fixture studs where required.
   2. Boxes for shall be 1-1/2 inch deep by 4-inch square minimum.
   3. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.12 PULL, SPLICE AND JUNCTION BOXES

A. Indoor general-purpose boxes shall be a NEMA 1 enclosure, constructed of code gauge galvanized steel. The boxes shall be constructed from a single piece of steel with folded and welded corners. Boxes shall have hinged covers or flat removable, galvanized sheet metal covers held in place with binder head sheet metal screws.

B. Outdoor boxes surface mounted above ground in wet locations shall be cast iron with a plain cast iron cover. Covers shall be neoprene gasketed and shall be NEMA 4 watertight construction. The cover shall be held in place by stainless steel screws.

C. Size boxes based on code and working space requirements related to the number and size of conduits and wire entering the box.

D. For recessed boxes, use an outside flanged recessed cover. For outdoor boxes mounted on exterior surfaces, use an un-flanged box with weather seals.

E. Conduit openings shall be bossed, drilled, and tapped in outdoor boxes.

F. Standard size metal boxes stamped from galvanized steel shall be used for indoor above ground general purpose where size and capacity are acceptable by code.

G. Boxes shall be of the depth required for wiring capacity.

H. Above ground outdoor boxes shall be cast iron with threaded hubs for vapor tight and wet locations where indicated.

I. Boxes for hazardous (classified) locations shall be approved for the classification and use.

J. Provide boxes with a blank cover.

K. Hinged Enclosures: As specified in Section 26 27 16.

2.13 UNDERGROUND BOXES

A. Underground boxes 24-inches square or larger shall be high density reinforced concrete with end and side knockouts. All such boxes shall be back filled around the outside with concrete. Each shall be equipped with the following reinforced concrete accessories:
   1. Extensions as required.
   2. Box floor
   3. Lid with hold down bolts and labeled with usage. (Steel checker plate with hold down bolts in traffic areas.)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Contractor shall have reviewed and approved Seismic Shop Drawings prior to installation of raceways which require seismic support.

B. Ground and bond raceway and boxes in accordance with Section 26 05 26.

C. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

D. Identify raceway and boxes in accordance with Section 26 05 53.

E. Arrange raceway and boxes to maintain headroom and present neat appearance.

F. Maintain minimum 12” clearance from top of suspended ceiling to bottom of conduits where possible.

G. Electrical wiring, conduits and boxes may not be installed within 1 ½” of metal deck roofs.

3.4 INSTALLATION - RACEWAY

A. Provide completely separate raceways for the life safety, critical, equipment, and normal branch power systems in accordance with the CEC.

B. Conceal all conduits, except in unfinished spaces such as equipment rooms or were indicated by symbol on the drawings or as approved by the University's Representative. Run concealed in areas having finished ceilings and furred walls.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Do not route flexible conduit through rated or non-rated walls.

J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 2-inch clearance between raceway running perpendicular to piping with temperatures exceeding 104 degrees F.

M. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Provide pull boxes or junction boxes in conduit runs over 90' long or when more than 4 quarter bends occur in a conduit run.

R. Install conduit bodies to make sharp changes in direction, as around beams.

S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

T. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control or expansion joints.

U. Fittings for IMC or rigid steel conduits shall be assembled with anti-corrosion, conductive anti-seize compound at joints made to exclude water.

V. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in boxes and wireway.

3.5 USES PERMITTED

A. Galvanized rigid conduit or IMC shall be used as follows:
1. For primary and secondary service (except when installed below the ground floor slab and above the building mat slab) and for secondary unit substations, switchboard, motor control center, dry-type transformer, and panelboard feeders.
2. Buried in or in contact with earth to be half-lapped with omic pipe wrapping tape with sealant applied to all joints.
3. In poured concrete walls, floor, and roof construction, provided a minimum of 2" of cover is maintained.
4. In all walls up to the first outlet box where fed from rigid conduit in damp locations or locations exposed to the weather.
5. In exposed locations below 8 feet above the floor, including all mechanical rooms.
6. All elbows for underground plastic conduit.
7. All conduits for interior wiring systems whose voltage is above 600 volts.
8. All conduits entering refrigerated spaces.
9. Elsewhere where indicated on the drawings.
10. For emergency branch feeders and circuits installed outside of building.

B. Electrical metallic tubing (EMT) shall be used as follows:
1. Concealed in stud partitions and hollow masonry walls.
2. For connections from junction box to lighting fixtures except in accessible ceilings.
3. In suspended or accessible ceilings above 8 feet.
4. Exposed in dry locations above 8 feet where not subjected to mechanical damage.
5. In furred ceiling spaces.

C. Rigid non-metallic conduit shall be used as follows:
   1. For the branch circuit wiring for exterior lighting pole bases and bollards (horizontal runs only).
   2. All elbows, both vertical and horizontal, shall be GRC.
   3. Any non-metallic PVC conduit used for emergency power systems shall be schedule 80 PVC.
   4. The communications conduit shall be scheduling 40 PVC.

D. Flexible steel conduit shall be used as follows:
   1. Recessed lighting fixtures. (6ft max)
   2. Motor connections.
   3. Connection between fan plenum and structure.
   4. At expansion joints.
   5. At transformers and other equipment which produces vibration.
   6. At damp and wet locations or where exposed to weather, flexible steel conduit shall be liquid tight type.
   7. Up to 20 feet of length is permitted between receptacles and light fixtures within the same single room.
   8. Tite-bite type connectors shall be used.
   9. All flexible steel conduit shall be used with code sized ground wire installed.
   10. All homeruns shall be in conduit, do not use flexible conduits for any homeruns routed to panels.

E. All other conduit, unless excluded herein, not permitted in accordance with the California Electrical Code, or otherwise indicated on the drawings, shall be electrical metallic tubing (EMT).

F. Conduit types shall not be mixed indiscriminately with other types in the same run, unless specified herein or required by the CEC.

G. Use flexible conduit for connections to motors, dry type transformers, electrical duct heaters, unit heaters, and flush mounted lighting fixtures. Conduit must be secured.
   1. Flexible conduit used for connection of motor, dry type transformers, electric duct heaters, and unit heaters, shall not exceed 18" in length.
   2. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 feet in length.
   3. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
   4. Liquid tight conduit shall be used to connect equipment in mechanical equipment rooms and exterior installations, and for final connections to all equipment containing water or other liquid service.

H. No conduit requiring cutting of cross-webs of concrete masonry units is permitted. Conduit shall be threaded through cells or concrete masonry units lowered around conduit. Neither horizontal joint reinforcement nor bond beam reinforcement shall be cut for conduit installation.

I. Where hazardous locations, as classified by the CEC, exist, all conduits and fittings and the installation of these materials shall comply with Article 500.

J. Direct Burial PVC Conduit
   1. Minimum size 1.0.”
   2. Unless otherwise indicated install top of conduits 24" minimum below finished grade. All conduits not under building slabs or parking lots shall be encased in a minimum of 3" concrete. All concrete for primary conduit shall contain a red pigment dye to make it readily noticeable. Provide 10% red oxide per cubic yard of material.
   3. Install top of conduits 30" minimum below grade, below roads and any other paved surfaces.

4. Place a 4" wide, bright yellow, non-biodegradable plastic tape 12" above all underground conduit outside of building foundation.
5. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab, make transition with rigid galvanized elbow and extend through slab or above grade with galvanized rigid steel conduit. For corrosion protection, where the elbow penetrates surface, wrap with vinyl all-weather electrical tape for 6" above and below concrete surface.
6. For all underground runs of two or more conduits, separators or spacing blocks made of plastic or other suitable nonmetallic, non-decaying material shall be placed on not greater than four-foot centers. They shall be of the interlocking type both horizontally and vertically. Ducts shall be anchored to prevent movement during placement of concrete.

K. Raceway Installations Within Concrete
1. Conduits shall not be installed within shear walls unless specifically indicated on the drawings. Conduits shall not be run directly below and parallel with load bearing walls.
2. Conduit stub-up penetrations through slabs shall be installed with the top of a threaded conduit coupling flush with the finished slab.
3. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.

3.6 INSTALLATION - BOXES

A. Boxes for Concealed Conduits:
1. Flush mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

C. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

D. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

F. In Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 24 inches from ceiling access panel or from removable recessed luminaire.

G. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

H. Provide acoustical rated moldable putty pads for all boxes located in acoustic rated walls.

I. Provide fire rated moldable putty pads for all boxes located in fire rated walls.

J. Secure flush mounting box to interior wall and partition studs with screws, not nails. Use box support bracket with far side support leg for outlets installed on wall studs.

K. Install stamped steel bridges to fasten flush mounting outlet box between studs.

L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

M. Install adjustable steel channel fasteners for hung ceiling outlet box.

N. Do not fasten boxes to ceiling support wires or other piping systems.

O. Support boxes independently of conduit.

P. Install gang box where more than one device is mounted together. Do not use sectional box.

Q. Install gang box with plaster ring for single device outlets.

R. Outlet boxes located below eight feet in exposed interior dry locations shall be one piece drawn steel or cast type.

3.7 INSTALLATION CONCRETE COMPOSITE BOXES

A. Install boxes direct buried in earth or concrete flush with surface, square with surrounding structures.

B. Provide hold down bolts for all covers.

C. Provide minimum 12” depth of crushed rock or pea gravel below boxes for drainage. Ground bond steel cover plate with insulated green grounding conductor.

D. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.8 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in other Sections.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.9 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.10 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Wire markers.
3. Junction box identification.
4. Inscribed cover plates.
5. Underground Warning Tape.

1.2 QUALITY ASSURANCE

A. Provide material supplied by a manufacturer producing identification systems.

B. Comply with OSHA, NFPA or local jurisdiction identification requirements for electrical systems.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Provide engraved plastic-laminate sign on each major unit of electrical equipment in building, including:
1. Electrical cabinets, panels, switchboards, and enclosures.
2. Transformers.

B. Each individually mounted circuit breaker, and each breaker in the switchboards, secondary unit substations, and distribution panels shall have a nameplate.

C. Nameplates shall have ½” high text lettering on 1-1/2” high nameplate (with 2” high used for nameplates with multiline text).

D. Nameplates shall be color coded to match existing electrical system.

E. Equipment identification is to indicate the following:
1. Equipment ID abbreviation.
2. Voltage, phase, and wires.
3. Power source description or system.
4. Power source origination.
5. Example: Panel SLGHA1; 480/277V, 3 Ø, 4 W.
6. Life Safety System; Fed by EM1

F. Minimum nameplate thickness: 1/16 inch for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Furnish with pre-punched holes for mechanical fasteners.

G. All electrical devices and switches shall have engraved device covers, 1/8” high letters. Include panel name and circuit number.

2.2 BOX IDENTIFICATION:

A. After completion, using an indelible wide tip marker, indicate on the cover of each junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5.

B. After box installation and wire termination completion all junction box and pull box covers shall be field marked/painted as follows:
   1. Normal branch power circuits "Green"
   2. Emergency branch power circuits "Red"

2.3 WIRE MARKERS

A. Description: Self-adhering, pre-printed or machine printable, self-laminating vinyl wrap around strips. Inscribe blank markers using the printer recommended by the manufacturer for this purpose.

B. All conductors shall be marked and identified. Include voltage, phase, and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present.

C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
   2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4 inch wide, for identification of phase conductors.

2.5 UNDERGROUND WARNING TAPE

A. Description: 6-inch-wide plastic tape, detectable type, colored yellow or red with suitable warning legend describing buried electrical lines.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates, labels, and markers.

D. Provide updated, type written, panelboard schedules for all branch circuit work completed as part of renovation and/or new construction projects. Schedules shall include the load description and the room number or area installed.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
2. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
3. Fasteners for equipment or device tag identification shall be self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot be used or should not penetrate the substrate material of the equipment.

C. Nameplates for signal systems equipment and devices are to be black except as follows:
1. Fire alarm and life safety - White with red letters

D. Inscribed Electrical Device Cover plate:
1. General: Lettering type shall be Helvetica, 12 point or 1/8" high. Color of characters shall be black. Locate the top of the inscription 1/2" below the top edge of the cover plate. Inscription shall be centered and square with cover plate.
2. Provide inscribed cover plates for devices as outlined below:
   a. Receptacles and switches.
   b. Outlets in surface raceways.
   c. Multi-ganged (four or more) switch arrangement.
   d. Special purpose switches, i.e., projection screens, shades, exhaust fans, etc.

E. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
2. Provide colored plastic phase tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made.

F. Box Identification:
1. After completion, using an indelible wide tip marker, indicate on the cover of each junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5.
2. All junction and pull boxes for wiring systems above 600V shall be identified with high voltage warning labels installed every 20 linear feet in accordance with OSHA standards. All boxes shall also be painted red.

G. After box installation and wire termination completion all junction box and pull box covers shall be field marked/painted as follows:
1. Normal branch power circuits "Green"
2. Emergency branch power circuits "Red"

H. Conduit and Raceway Identification:
1. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

3.4 UNDERGROUND WARNING TAPE:

A. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

3.5 BRASS TAGS:

A. Provide brass tags for all feeder cables in underground vaults and pull boxes.

B. Provide brass tags for empty conduits in underground vaults, pull boxes and stubs.

3.6 WARNING, CAUTION, AND INSTRUCTION SIGNS

A. Provide warning, caution or instruction signs where required by OSHA, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems.
   1. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system of equipment operation.
   2. Provide polyester film self-adhesive signs of indoor/outdoor equipment and door warning. Use rigid polyethylene non-adhesive signs where adhesives will not work; for example, installing on a metal fence. Provide sign color and marking that meets OSHA regulations. For example, DANGER (red background with white letters), HIGH VOLTAGE (white with black letters.
      a. Use 2 by 4-inch signs for small equipment or enclosure doors.
      b. Use 7 by 10 inch or 10 by 14-inch signs for large equipment or enclosure doors.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

3.7 FIRESTOPPING

A. Firestopping shall be labeled at each location where installed, on each side of the penetrated fire barrier, and within 12 in. of the firestopping material.

END OF SECTION

SECTION 26 05 73

SHORT-CIRCUIT COORDINATION STUDY AND ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes short circuit and protective device coordination studies encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, and main breaker in each panelboard.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

C. Related Sections:
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 22 00 - Low-Voltage Transformers.
   3. Section 26 24 16 - Panelboards.
   4. Section 26 28 19 - Enclosed Switches.
   5. Section 26 28 23 - Enclosed Circuit Breakers.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. ANSI/NETA ATS – 2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems.

B. Institute of Electrical and Electronics Engineers:
   1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

C. Part 3, Title 24, - California Electrical Code (CEC).

D. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations

E. NFPA 70E – Standard for Electrical Safety in the Workplace

1.3 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY

A. Complete Short Circuit, Protective Device Coordination Study and Arc Flash Hazard Analysis to meet requirements of NFPA 70.

B. Report shall demonstrate that all emergency system overcurrent devices are selectively coordinated to restrict outages to the circuit or equipment affected. This shall be accomplished by providing overcurrent protective devices and their ratings or settings, utilizing the 0.10 second level of the overcurrent protective device from the time-current curve as the basis for the lower limit of the calculation method.

C. Report Preparation:
1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
2. Perform study with aid of computer software program.
3. Obtain actual settings for equipment incorporated into Work.
4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
   a. Low-voltage switchgear.
   b. Switchboards.
   c. Distribution panelboards.
   d. Branch circuit panelboards.
   e. Each other significant equipment location throughout system.

D. Report Contents:
1. Include the following:
   a. Calculation methods and assumptions.
   b. Base per unit value selected.
   c. One-line diagram.
   d. Source impedance data including power company system available power and characteristics.
   e. Typical calculations.
      1) Fault impedance.
      2) X to R ratios.
      3) Asymmetry factors.
      4) Motor fault contribution.
      5) Short circuit kVA.
      6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
      7) Tabulations of calculation quantities and results.
   f. One-line diagram revised by adding actual instantaneous short circuits available.
   g. Incident energy and flash protection boundary calculations.
   h. State conclusions and recommendations.
2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
4. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
   a. Low voltage equipment circuit breaker trip device characteristics.
   b. Low voltage equipment fuse characteristics.
   c. Cable damage point characteristics.
   d. Pertinent transformer characteristics including:
      1) Transformer full load current.
      2) Transformer magnetizing inrush.
      3) ANSI transformers withstand parameters.
      4) Significant symmetrical fault current.
   e. Pertinent motor characteristics.
   f. Generator characteristics including:
      1) Phase and ground coordination of generator protective devices.
      2) Decrement curve and damage curve.
      3) Operating characteristic of protective devices.

4) Actual impedance value.
5) Time constants.
6) Current boost data.
7) Do not use typical values for generator.

g. Transfer switch characteristics.
h. Other system loads protective device characteristics.

1.4 Arc Flash Hazard Analysis

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.

B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, equipment disconnects, busway and splitters) where work could be performed on energized parts.

D. The Arc-Flash Hazard Analysis shall include all MV, 575v, & 480v locations and significant locations in 240 volt and 208-volt systems.

E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

F. For arc flash calculations, the worst-case scenario is not always described by the greatest magnitude of fault current. The Arc Flash Analysis shall use the maximum and minimum available fault current available at the utility to consider several scenarios and providing a worst-case scenario for each system location. The arc flash analysis will, therefore, include calculations for maximum and minimum contributions of fault current magnitude.

G. Motors receiving power via variable frequency drives are not considered to have fault contributions. All motors less than 50hp shall be lumped into a single motor model. All motors are to be considered running (contributing).

H. Arc flash computation shall include both line and load side of main breaker calculations, where necessary. The worst-case scenario incident energy value (Cal/cm2) shall be applied to the Arc Flash label.

I. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-20018 section B.1.2.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Qualifications Data: Submit the following for review prior to starting study.
1. Submit qualifications and background of firm.
2. Submit qualifications of Professional Engineer performing study.

C. Software: Submit for review information on software proposed to be used in performing study.

D. Product Data: Submit the following:

1. Short Circuit and Coordination Study: Summarize results of study in report format including the following:
   a. Descriptions, purpose, basis, and scope of study.
   b. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
   c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
   d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
2. Incident energy and flash protection boundary calculations.
   a. Arcing fault magnitude
   b. Device clearing time.
   c. Duration of arc
   d. Arc flash boundary
   e. Working distance
   f. Incident energy
   g. Hazard Risk Category
   h. Recommendations for arc flash energy reduction

E. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments from EEOR.

1.6 QUALITY ASSURANCE

A. Maintain one copy of document on site.

B. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of 5 years availability approved by Architect/Engineer.

C. Perform study in accordance with IEEE 242.

1.7 QUALIFICATIONS

A. Study Preparer: Company specializing in performing work of this section with minimum 5 years experience.

B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California five years' experience in power system analysis.

C. Demonstrate company performing study has capability and experience to help during system start up.

1.8 SEQUENCING

A. Allow 2 weeks for review of completed study by Architect/Engineer.

B. Submit short circuit protective device coordination study and arc flash hazard analysis studies to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

C. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.9 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.10 COORDINATION

A. Coordinate work with local power company.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Aid electrical distribution system equipment manufacturer during start up of electrical system and equipment.

3.2 ADJUSTING

A. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

3.3 ARC FLASH WARNING LABELS

A. The vendor shall provide a 4 in. x 6 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD,” and shall include the following information:
   1. Location designation
   2. Nominal voltage
   3. Flash protection boundary
   4. Incident energy
   5. Working distance
   6. Engineering report number, revision number and issue date

C. Labels shall be machine printed, with no field markings.

D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
   1. For each 600, 480 and applicable 208-volt panelboards and disconnects, one arc flash label shall be provided.
   2. For each motor control center, one arc flash label shall be provided.
   3. For each low voltage switchboard, one arc flash label shall be provided.
   4. For each switchgear, one flash label shall be provided.
   5. For medium voltage switches one arc flash label shall be provided

3.4 AVAILABLE FAULT CURRENT LABEL

A. The vendor shall provide a 4 in. x 6 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The label shall have the wording, “AVAILABLE FAULT CURRENT,” and shall include the following information:
   1. Project Name
   2. Fault Name
   3. Available Fault Current
   4. Voltage
   5. Date of Calculation

3.5 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

GENERAL

SUMMARY

A. Section includes two-winding transformers and shielded transformers.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
2. Section 26 05 53 – Identification for Electrical Systems.

REFERENCES

C. National Electrical Manufacturers Association:

1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.
3. DOE (Department of Energy) 2016 Standard for Energy Efficiency.

D. International Electrical Testing Association:

1. ANSI/NETA ATS 2017 - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

SUBMITTALS

E. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

F. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

G. Seismic Qualification: Submit manufacturer’s certificate of seismic compliance in accordance with the American Society of Civil Engineers ASCE/SEI 7-05 and the California Building Code.

CLOSEOUT SUBMITTALS

H. Project Record Documents: Record actual locations of transformers.

QUALIFICATIONS

I. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

J. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2006 International Building Code.

K. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

DELIVERY, STORAGE, AND HANDLING

L. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

M. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PRODUCTS

2.2 TWO-WINDING TRANSFORMERS

A. Manufacturers:
   1. Powersmith

B. Product Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers; ratings as indicated on Drawings.

C. Primary Voltage: 480 volts, 3 phase.

D. Secondary Voltage: 208Y/120 volts, 3 phase.

E. Insulation system and average winding temperature rise for rated kVA as follows:
   1. 1-15 kVA: Class 185 with 80 degrees C rise.
   2. 16-500 kVA: Class 220 with 150 degrees C rise.

F. Efficiency Levels: Ventilated dry type transformers rated 15 kVA and larger shall have energy efficiencies that meet or exceed the latest requirements of the California Code of Regulations Title 20 and Title 24, DOE 2016 Standard. Transformers shall be Energy Star labeled.

G. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

H. Winding Taps:
   1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   2. Transformers 15 kVA and Larger: NEMA ST 20.

I. Sound Levels: NEMA ST 20.

J. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

K. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.

L. Mounting:
   1. 1-15 kVA: Suitable for wall mounting.
   2. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor or trapeze mounting.

M. Coil Conductors: Continuous copper windings with terminations brazed or welded.

N. Enclosure: NEMA ST 20, Type 1 Type 3R ventilated non-ventilated. Furnish lifting eyes or brackets.

O. Isolate core and coil from enclosure using vibration-absorbing mounts.

P. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.3 SOURCE QUALITY CONTROL

A. Production test each unit according to NEMA ST20.

EXECUTION

3.2 EXAMINATION

A. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.3 EXISTING WORK

A. Disconnect and remove abandoned transformers.

B. Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.

C. Clean and repair existing transformers to remain or to be reinstalled.

3.4 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers in accordance with Section 26 05 29.
   1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
   2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
   3. Mount trapeze-mounted transformers as indicated on Drawings.

D. Provide seismic restraints.

E. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

F. Unless labeled otherwise, ventilated transformers shall have all sides located at least 6 inches away from walls or other obstructions.

G. Install grounding and bonding in accordance with Section 26 05 26.

3.5 FIELD QUALITY CONTROL

A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.2.1.1A.

B. Perform electrical tests in accordance with NETA ATS, 7.2.1.1B.

C. Provide written test results of insulation test and thermographic survey to Architect.

3.6 INDEPENDENT TESTING ORGANIZATION AND PERSONNEL

A. Obtain the services of an independent third party testing organization to perform electrical tests.

B. Independent testing organization and personnel shall meet the requirements of NETA ATS 3.1 and 3.2.

C. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Architect.

3.7 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution and branch circuit panelboards.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
5. NEMA PB 1 - Panelboards.
6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:
1. ANSI/NETA ATS 2017 - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

D. Underwriters Laboratories Inc.:
1. UL 67 - Safety for Panelboards.
2. UL 1449 – Surge Protection Devices.

1.3 SUBMITTALS

A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

B. Product Data: Submit catalog data showing specified features of standard products and list the following information:
1. Panel designation
2. Voltage rating
3. Current rating
4. Top, bottom or through feed lugs, lug size
5. Main overcurrent device size.
6. Branch device schedule, listing size and poles.
7. Surface trim or recessed.

8. Fault current rating of the panel and devices
9. Circuit breaker mounting method - bolt-in.
10. Bus material.
11. Indicate any special requirements including key locking, split bus, contactor panels, double panels, or panels in special NEMA enclosures.
12. Indicate which panelboards are electronic grade.

C. Seismic Qualification: Submit manufacturer's certificate of seismic compliance in accordance with the American Society of Civil Engineers ASCE/SEI 7-05 and the California Building Code.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

B. Operation and Maintenance Data: Submit spare parts listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the California Building Code.

C. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared, and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.6 MAINTENANCE MATERIALS

A. Furnish two of each panelboard key. Panelboards keyed alike.

PART 2 - PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:

1. Square D.

B. Product Description: NEMA PB1, circuit breaker type, lighting, and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish

copper ground bus in each panelboard. Furnish isolated ground bus were indicated on Drawings.

D. Ground Bus: 50% capacity of the phase bus with lugs and terminals for terminating the sizes and quantity of ground conductors indicated and required.

E. Provide 100 percent rated Neutral. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.

F. Minimum fully rated Short Circuit Rating:
   1. 10,000-amperes RMS at 208V, or as shown on Drawings.
   2. 35,000-amperes RMS at 480V, or as shown on Drawings.

G. Panelboard circuit breakers shall match the kAIC rating and manufacturer of the enclosure.

H. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, Class A ground fault interrupter circuit breakers as indicated on Drawings.
   1. Circuit breaker handle locks shall be provided for all circuits that supply emergency egress lights, energy management and control system (EMCS) panels and fire alarm panels.
   2. Circuit breakers shall be molded case, thermal magnetic trip type with common trip handle for all poles.

I. Include adjustable trip breakers where required to achieve selective coordination or limit fault current as coordinated with the results of the contractor prepared power system study.

J. When indicated on the drawings provide a microprocessor-based GE ASPERMETER Series Panelboard Monitoring System. The system shall be provided with all features and requirements necessary to interface with the existing campus GE PMCS Systems and the existing campus JCI Metasys system. Upgrades in the existing GE PMCS and Metasys systems shall be provided as necessary to integrate the panelboard metering system.

K. Main circuit breakers shall be bus connected to the panel, vertically mounted, and not group aligned in branch breaker positions, include lock off hardware.

L. Enclosure: NEMA PB 1, Type 1.

M. Cabinet Box: 6 inches deep, 20 inches wide.

N. Trim: Cabinet front with concealed trim clamps and flush lock all keyed alike. Trim shall be dead front with metal frame index holder on inside of door. Panelboard enclosures shall be provided with either a flush or surface trim as indicated in the Panelboard Schedule or shown on the plan. Trim shall be painted baked on ANSI #61, light gray enamel. Covers shall be hinged so that they swing away to provide full access to the interior of the panel without removing the cover. Covers designed for more than one panel section shall not be permitted. Hinged type door covering all circuit breakers shall be included in all panel trims.

2.2 SURGE PROTECTION DEVICES

A. Electrical Requirements
   1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
   3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other

components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	**L-N**	**L-G**	**L-L**	**N-G**
Wye	●	●	●	●
Delta	**N/A**	●	●	**N/A**
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA in rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an in less than 20kA shall be rejected.
6. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
      1) For wye configured units, the indicator lights must report the status of all protection

elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

2) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur, that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

C. System Application

1. The SPD applications covered under this section shall be tested and demonstrate suitability

for application within ANSI/IEEE C62.41 Category B, and A environments.

D. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
B	Distribution Panelboards	160 kA	80 Ka
A	Branch Panelboards	120 kA	60 kA

E. SPD Type – All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect abandoned panelboards. Remove abandoned panelboards.

B. Maintain access to existing panelboard remaining active and requiring access.

C. Clean and repair existing panelboards to remain or to be reinstalled.

3.2 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Maximum height: 6’-6” to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide 8 ½” by 11” minimum typed circuit directory with clear plastic covering inside panel door for each branch circuit panelboard. Contractor shall clearly identify locations and specific purpose of circuits.

G. Schedules shall include:

1. Panel designation.
2. Panel location.
3. Voltage, phase, current rating.
4. Main overcurrent device size.
5. Branch circuit listing indications circuit number and description of loads served.
6. Source of panel feeder.
7. Panel schedule book shall be assembled based on "As Built" information and submitted to the University upon completion of the project. Provide one hard copy of book and provide one CD or Zip-disk containing updated panel schedules in MS Excel format.

H. Install engraved plastic nameplates in accordance with Section 26 05 53.

I. Install spare conduits out of each recessed panelboard to accessible location above ceiling.

Minimum spare conduits: 3 empty 1 inch. Identify each as SPARE.

J. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Perform visual and mechanical inspections listed in NETA ATS, Section 7.6.1.1.A.

B. Perform tests listed in NETA ATS, Section 7.6.1.1.B.

3.4 ADJUSTING

A. Adjust all variable trip circuit breakers to the proper setting for the load each circuit breaker is protecting. Retest to verify the setting is correct and adjust as needed. After the settings are completed, record the panel number, device number with the load trip point that the device has been adjusted for and the name and size of the load on a typed separate sheet of paper. Place one copy of this paper in the panel directory pocket and provide one copy with each operation and maintenance manual.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:
   1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

B. All switches, receptacles and device plates throughout project shall be from the same manufacturer unless otherwise specified.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
   1. Pass & Seymour
   2. Leviton
   3. or equal

B. Product Description: Industrial Grade, NEMA WD 1, Heavy-Duty, AC only quiet toggle switch.

C. Body and Handle: Ivory thermoplastic with toggle handle red color for devices connected to emergency power system.

D. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

E. Indicator Light: Separate pilot strap; red color lens.

F. Locator Light: Lighted handle type switch; green color handle.

G. Ratings:
1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

2.2 RECEPTACLES

A. Manufacturers:
1. Pass & Seymour
2. Hubbell
3. Leviton
4. Cooper
5. Approved equal.

B. Product Description: Specification Grade, NEMA WD 1, Heavy-duty general use receptacle. Grounding system shall be all brass and integral to the wrap around mounting strap. Combination head brass grounding screw. Brass alloy triple wipe contacts shall grip both sides of plug prongs.

C. Device Body: Ivory thermoplastic. Red for devices connected to Emergency circuits. Red for devices connected to Emergency circuits.

D. Wiring: Back and side wired. Back wiring with wrap-around steel strap clamp type terminals suitable for stranded or solid wire.

E. Configuration: NEMA WD 6, type as indicated on Drawings.

F. Convenience Receptacle: Duplex type 5-20.

G. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

H. Tamper Resistant Receptacle: Convenience receptacle with internal spring-loaded mechanical shutter. Type 5-20.

I. Special Purpose Receptacles: Type and rating and number of poles indicated or required for the anticipated purpose.

2.3 WALL PLATES

A. Color, Material and Locations:
1. Interior: Brushed stainless steel with stainless steel screws at all locations, except as indicated below.
2. Unfinished Areas: In tunnels, above ceilings and in unfinished areas, device plates shall be galvanized steel utility type.
3. Weatherproof Outlets: Provide cast aluminum plate with a hinged backing double lift cover and gasket allowing either surface or recessed mounting. Plate shall allow horizontal mounting of a duplex receptacle with a horizontal hinge. Hubbell #5205 or equal for standard boxes or Hubbell #5206 or equal for FS boxes. GFI outlets shall be provided with an appropriate cover.

B. Weatherproof Wet Location Cover Plate: Extended polycarbonate hinged cover for use when attachment plug is inserted.

2.4 MULTIOUTLET ASSEMBLY

A. Multi-outlet Assembly: Sheet metal channel with fitted cover, suitable for use as multi-outlet assembly.

B. Size: As indicated on Drawings.

C. Receptacles: Furnish covers and accessories to accept receptacles specified in this Section.

D. Receptacles: NEMA WD 6, type 5-20R.

E. Receptacle Spacing: As indicated on Drawings.

F. Channel Finish: Gray enamel.

G. Fittings: Furnish manufacturer's standard couplings, elbows, and connectors

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Mounting heights shown shall be measured from finished floor to the center of the outlet box.

C. Install switches with OFF position down.

D. Install all outlet boxes for light switches flush in wall where possible. Where more than one switch appears at the same location, they shall be installed in a ganged box with a single plate.

E. Where receptacles are shown adjacent to other devices, the boxes shall be installed with 2" between devices of other systems.

F. Install receptacles with grounding pole on top.

G. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Terminate ground wire at device where ground wire is provided within the raceway system.

J. Carefully strip thermoplastic wire to length and make-up terminal connection as recommended by the device manufacturer.

K. Secure device to outlet box with proper screws.

L. Use jumbo size plates for outlets installed in masonry walls.

M. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 Labels and Inscriptions:

A. Identify receptacle cover plate with panel and branch circuit number (for example L2A-3). Engrave and fill with 1/8” high black letters. Red for emergency system outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.

3.7 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify each receptacle device is energized.

D. Test each receptacle device for proper polarity and grounding.

E. Test each GFCI receptacle device for proper operation.

3.8 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.9 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fusible and non-fusible switches.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. ANSI/NETA ATS - 2017Acceptance Testing Specifications for Electrical Power Equipment and Systems.

1.3 SUBMITTALS

A. Product Data: Submit switch ratings and enclosure dimensions.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square D.

B. Product Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

E. Furnish switches with entirely copper current carrying parts.
   1. NONFUSIBLE SWITCH ASSEMBLIES

F. Manufacturers:
   1. Square D.

G. Product Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

H. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R 4X stainless steel.

I. Furnish switches with entirely copper current carrying parts.

2.2 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating:
   1. Non-Fused Switches: UL listed for 10,000 rms symmetrical amperes.
   2. Fused Switches: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere) 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

B. Install fuses for fusible disconnect switches.

C. Install engraved plastic nameplates in accordance with Section 26 05 53.

D. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Provide visual and mechanical inspections per NETA ATS 7.5.1.1.A.

END OF SECTION

SECTION 26 33 00

BATTERY EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes emergency power supplies and accessories.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems.

B. 2022 California Fire Code

1. Section 1207 Electrical Energy Storage Systems ‘ESS’.

1.3 SUBMITTALS

A. Product Data: Submit catalog and data sheets showing electrical characteristics and connection requirements. Include unit ratings, dimensions, and finishes. Include performance data for batteries.

B. Seismic Qualification: Submit manufacturer’s certificate of seismic compliance in accordance with the American Society of Civil Engineers ASCE/SEI 7-16 and the California Building Code.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit battery maintenance and unit testing procedures.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 111.

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the California Building Code.

C. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. ~~The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.~~
2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.7 WARRANTY & STARTUP SERVICES

A. Furnish five year manufacturer warranty for batteries.

B. Provide 7x24 startup services.

1.8 EXTRA MATERIALS

A. Furnish Seismic Anchor Kits included for the Centralized UPS System

PART 2 PRODUCTS

2.1 EMERGENCY POWER SUPPLY

A. Manufacturers:

1. Vertiv Liebert EXM series

B. Product Description: UL 1778 type centralized UPS stored emergency power supply system designed for information technology equipment applications and consisting of rectifier/charger unit, storage battery, and solid-state inverter with static transfer switch, in one or several enclosures.

C. Input Voltage: 208V, 60 Hz, three phase.

D. Output Power: Scalable 10-40 kVA at 0.8 power factor. Coordinate with University on initial size of scalable unit.

E. Output Voltage: 208Volts, three phase.

F. Inverter Output Frequency: 60 Hz.

G. Efficiency: 90 percent minimum.

H. Total Harmonic Distortion: Less than 10 percent at full resistive load.

I. Battery: Lead-Acid, Sealed Lead Acid, or VRLA type battery.

J. Charger: Dual rate, designed to maintain battery in full-charge condition during normal conditions. See Plans for Battery operating time at full load.

K. Input Circuit Breaker: Furnish with factory mounted circuit breaker within enclosure.

L. Output Circuit Breakers: Furnish with Maintenance Bypass Circuit Breaker and UPS Output Circuit Breaker which are capable of feeding an external 120/208V, 3 Phase, 4 Wire branch circuit electrical panel.

M. Short Circuit Rating: 65KAIC.

N. (1) Intellislot Unity Dual Protocol remote monitoring card.

O. Provide 7x24 tech support.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

3.2 FIELD QUALITY CONTROL

A. Verify operation of each unit by simulating outage.

3.3 DEMONSTRATION AND TRAINING

A. Demonstrate normal operation of unit.

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. Underwriters Laboratory
1. UL 8750-09 - Light Emitting Diode (LED) Light Sources for Use in Lighting Products.

1.3 SUBMITTALS

A. Product Data: Submit dimensions, ratings, and performance data.

B. Provide lighting fixtures complete with lamps, completely wired, controlled, and securely attached to supports.

C. Contractor shall provide entire lighting specification (including fixture catalog cuts and sketches) for each specified manufacturer with complete information about the fixtures they will supply.

D. Type of fixtures shall be as indicated alphanumerically and as specified.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.

B. Manufacturer:
1. Lithonia with integrated nLight controller.
2. Or equal with remote nLight controller.

2.2 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.90.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.
   b. Minimum CRI 90 and color temperature 3500˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
   c. Minimum Rated Life: 50,000 hours per IES L70.
   d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
5. LED lamps shall be capable of continuous dimming, without flicker or noise, from 10-100 percent.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, and accessories.

3.2 INSTALLATION

A. Provide mounting accessories as required for ceiling construction. Fixture catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a fixture may be installed.

B. Provide adequate and sturdy support for each lighting fixture. Verify weight and mounting method of fixtures and furnish and install suitable supports. Fixture mounting assemblies shall comply with local seismic codes and regulations.

C. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

D. Support luminaires independent of ceiling framing.

E. Locate recessed ceiling luminaires as indicated on Reflected Ceiling Plan.

F. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

G. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure.

H. Install recessed luminaires to permit removal from below.

I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Install clips to secure recessed grid-supported luminaires in place.

K. Install wall-mounted luminaires at height as indicated on Drawings.

L. Install accessories furnished with each luminaire.

M. Connect luminaires to branch circuit outlets provided under Section 26 05 33 using flexible conduit not exceeding 6 feet.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

O. Lighting fixtures recessed in ceilings which have a fire resistive rating of 1 hour or more shall be enclosed in a box which has a fire resistive rating equal to that of the ceiling.

P. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 CLEANING

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

END OF SECTION

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SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not necessarily limited to, common standards and procedures for the Communications Work.

B. This Section outlines areas of responsibility between Owner, Architect, and Contractor.

C. Owner will assist with a collaborative process to determine the most cost effective and efficient means to reach the common goal of providing communications within the facility for the project, including assessing user needs and assessing required pathways. The Owner is available upon request to assist at no additional cost to the project. It is incumbent upon the construction team management to approach and engage the Owner at the appropriate times for collaboration.

D. As part of the project, the construction team must design, engineer, and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter “support") of the Communications Systems; and provide engineering of such support by parties licensed to perform work of this type in the project jurisdiction.

1.2 ITEMS PROVIDED BY OWNER

A. Registered Communications Distribution Designer (RCDD) support services

B. IT project management

C. Submittal approvals

D. Network equipment

E. 802.11 Wireless Access Point hardware

1. Installation by construction team when wireless access point mounting requires seismic support or a construction activity such as screwing, drilling, or welding

2. Owner will provide 802.11 design services

F. Rack and Stack

G. Plug Pack Distribution (Pre-terminated switch port cabling provided and installed by the Owner)

H. Patch Cords and Patching

I. IT UPS System (installation by construction team)

J. PDU Power distribution Equipment

K. VOIP Router, Voice Gateway, VOIP equipment

L. Camera NVR/Server

M. Overhead Paging Amplifier

N. TV Distribution Amplifier

O. Closet Cleaning postproduction

1.3 ITEMS PROVIDED BY CONSTRUCTION TEAM

A. Building Drawings and Floor Plans

B. Site Plans

C. Furniture Plans

D. As-Built Drawing Submittals

1. As-built drawing per section 1.10

2. Cabling Schedule

3. Desktop Inventory Sheet

a. Spread sheet listing cable number and location for every cable installed

1) Cable number; room number, wall (north, south, east, west)

E. Attachments to structure

F. In wall cabling

G. In wall cabling supports

H. Wireless Access point installation

I. Cabling test results

J. Patch Panels

K. Horizontal Wire Managers

L. Vertical Wire Managers (installation by construction team)

M. Racks for mounting cabling and equipment (installation by construction team).

N. Horizontal cable, jacks, faceplates, surface mount boxes, cable trays, termination hardware, and all materials needed for a complete horizontal cabling plant as defined in the Section and associated Sections and the construction documents not otherwise listed for provision by the Owner.

O. Construction Clean Closet Cleaning

1.4 RELATED SECTIONS

A. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 REFERENCES AND STANDARDS

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

1. UC Davis Health Telecommunications Standards

2. American National Standards Institute (ANSI)

3. Telecommunications Industry Association (TIA)

4. Building Industry Consulting Services International (BICSI)

5. American Society for Testing and Materials (ASTM)

6. Institute of Electrical and Electronic Engineers (IEEE)

7. National Electrical Manufacturers Association (NEMA)

8. Underwriters Laboratories, Inc. (UL)

9. Local Authorities Having Jurisdiction (AHJ)

B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

1. United States Department of Labor (DOL) Regulations (Standards - 29 CFR)

2. Part 1910, “Occupational Safety and Health Standards”

3. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).

4. 2022 California Building Code (CBC).

5. 2022 California Fire Code (CFC).

6. 2022 California Mechanical Code (CMC).

7. National, State and any other binding building and fire codes.

8. FCC Regulations:

a. Part 15 – Radio Frequency Devices & Radiation Limits

b. Part 68 – Connection of Terminal Equipment to the Telephone Network

9. Underwriter's Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:

a. UL 444: Communications Cables

b. UL 497: Protectors for Paired-Conductor Communication Circuits.

c. UL 1651: Optical Fiber Cable

d. UL 1690: Data-Processing Cable

e. UL 1963: Communications-Circuit Accessories

f. UL 2024A: Optical Fiber Cable Routing Assemblies.

10. ANSI/TIA/EIA-568-D Commercial Building Telecommunications Cabling Standard.

11. ANSI/TIA/EIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces.

12. ANSI/TIA/EIA-598-B Optical Fiber Cable Color Coding.

13. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

14. ANSI/J-STD-607-D Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

15. ANSI/TIA/EIA-758 Customer-Owner Outside Plant Telecommunications Cabling Standard.

a. TIA/EIA-758-1 Addendum No. 1

16. EIA testing standards.

17. Insulated Cable Engineers Association (ICEA):

a. ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems

b. ANSI/ICEA S-83-596-2016 Fiber Optic Premises Distribution Cable

c. ANSI/ICEA S-87-640-2016 Fiber Optic Outside Plant Communications Cable

d. ANSI/ICEA S-90-661-2012 Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems

e. ICEA S-104-696-2019 Standard for Indoor-Outdoor Optical Cable

18. Telecommunications Distribution Methods Manual (TDMM)

1.6 ABBREVIATIONS

A. ADA Americans with Disabilities Act

B. AFC Above Finished Ceiling

C. AFF Above the Finished Floor

D. BDF Building Distribution Frame – See Telecommunications Room (TR)

E. BLDG Building

F. CAT Category (Related to network cable types)

G. DIV Division

H. (E) Existing

I. ER IT Equipment Room – See Telecommunications Room (TR)

J. GE Grounding Equalizer – Part of the Telecom Grounding System

K. HR Homerun

L. ID Inside Diameter

M. IDF Intermediate Distribution Frame – See Telecommunications Room (TR)

N. IT UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)

O. LAN Local Area Network

P. MAX Maximum

Q. NIC Not in Contract

R. OD Outside Diameter

S. TBB Telecom Bonding Backbone – Part of the Telecom Grounding System

T. TGB Telecommunications Ground Busbar

U. TMGB Telecommunications Main Ground Busbar

V. TR Telecommunications Room, TR may also be used interchangeably with ER, IDF, MDF, or Communications Room

W. TYP Typical

X. UCD UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)

Y. UFE University Furnished Equipment

Z. UON Unless Otherwise Noted

1.7 DEFINITIONS

A. Telecommunications Room (TR) – An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

B. Intermediate Distribution Frame (IDF) – See Telecommunications Room (TR)

C. Entrance Facility (EF) (Telecommunications) – An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

D. Pathway – A physical infrastructure utilized for the placement and routing of telecommunications cable.

E. Infection Control – Clinical Environment Infection Control or ICRA

F. “Cabling”: A combination of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].

G. “Identifier”: A unique code assigned to an element of the telecommunications infrastructure that links it to its corresponding record.

1.8 QUALITY ASSURANCE

A. Contractor Firm Qualifications:

1. All work for the Communications (low voltage) Infrastructure installation shall be self-performed by the Communications Contractor; subcontractors shall not be allowed under the Communications Contractor.

B. Communications Contractor shall:

1. Be a Panduit Corp. PCI (Panduit Certified Installer) Design and Installation Contractor or approved equal.

2. Be a firm which is regularly and professionally engaged in the installation and testing of the specified communications equipment and infrastructure.

3. Be licensed to install low voltage electronic cabling systems in the State of California where applicable (C7 License).

C. Communications Contractor shall demonstrate experience in providing successful installation of data infrastructure systems:

1. Submit documentation for a minimum of three and a maximum of five successful low voltage communications infrastructure system installation projects completed within the past three years.

D. Contractor Key Personnel Qualifications:

1. Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified low voltage communications systems, equipment and infrastructure. There may be one key person or more key persons proposed for this project depending upon how many of the key roles each has successfully provided.
2. Each of the key personnel shall demonstrate experience in providing successful low voltage communications systems, equipment and infrastructure within the past three years.

E. A Registered Communications Distribution Designer (RCDD) shall be employed by the Design Builder and directly engaged in the project for all Communications Infrastructure design and installation efforts.

1. The RCDD shall be a direct employee of the Communications Contractor, within the Design Build team structure.
2. The RCDD shall be required to have oversight and supervision of the entire Communications Infrastructure installation process and quality control.
3. The RCDD shall be the Design Builder's Designer of Record for the Communications Infrastructure scope of work.
4. RCDD direct responsibilities shall include but may not be limited to: Thorough coordination with Owner regarding all design and installation efforts related to the project. A Pre-construction coordination meeting and site inspection with Owner prior to beginning any work. Oversight of Communications installation efforts, development of shop drawings and assembly of product data submittals. Quality control review and stamping of finalized Communications as-built drawings for submittal to Owner. Quality control review of Communications systems installation throughout the entire construction phase, to ensure all work is performed in compliance with approved construction drawings.

F. Critical on-site quality control installation reviews to be conducted in conjunction with Owner technical staff shall include but may not be limited to:

1. Validation of design to conform with Infection Control guidelines required as it applies with the type of structure and services to be provided in each specific area.
2. Verifying proper installation of all Communications cable tray, backbone conduits, device back boxes, conduit infrastructure and cabling pathways. Site inspection and sign-off must be performed prior to concealing conduit infrastructure and prior to the installation of any low-volt cabling.
3. Verifying proper installation of all Communications cabling. Site inspection and sign-off must be performed prior to closing-up associated accessible ceilings.
4. Verifying the layout and installation of all equipment and cabling within the Telecom Rooms, throughout the duration of the construction phase.

G. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. Submit documentation for a minimum of three and a maximum of five successful cabling system installations for each of the key personnel in an environment resembling that which is being bid upon.

1. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of three years' experience in the installation of the specified copper and fiber optic cable and components. The personnel on site performing work pertaining to this job shall be certified on the system being installed. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.
2. Submit documentation for a minimum of three and a maximum of five successful cabling system installations for each of the key personnel in an environment resembling that which is being bid upon. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this project. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems.
3. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this project.
4. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project Owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

H. Indicate that all key persons are currently employed by the Communications Contractor or have a commitment to the Communications Contractor to work on this project. All key persons shall be employed by the Communications Contractor at the date of issuance of this project, or if not, have a commitment to the Communications Contractor to work on this project by the date that the bid was due to the Owner's Representative.

1. Note that only the key personnel approved by the Owner's Representative in the successful proposal shall perform work on this project's low voltage systems, equipment, and infrastructure. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the Communications Contractor's key personnel require approval from the Owner's Representative.

I. Designated Supervisor: Designate which key person will serve as a designated supervisor for the project. This supervisor shall be present and responsible for the project site during all phases of installation and testing of the Work in this Section. This supervisor shall be the same individual through the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

J. Submit documentation for a minimum of three and a maximum of five successful low voltage systems, equipment, and infrastructure installations for each of the key personnel.

K. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the low voltage communications systems, equipment and infrastructure proposed for this project. Include specific experience in installing and testing communications systems and provide the names and locations of at least two project installations successfully completed using systems and equipment substantially similar to those specified for this project.

L. All the existing low voltage communications systems, equipment and infrastructure installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this project.

M. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project Owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

1.9 SUBMITTALS

A. All Submittals shall be provided electronically in PDF format. All Drawing Submittals shall be provided in PDF and AutoCAD (latest version) DWG format.

B. Submittals shall be organized in a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.

C. Contractor shall submit the following items:

1. Contractor Key Personnel and Certifications

2. Complete Bill of Materials (BOM) List

3. Manufacturer Product Data Sheets, as defined below

4. Shop Drawings, as defined below

5. Proposed Installation Schedule

6. Cabling Certification Test Plan and proposed test equipment

D. Manufacturer Product Data Submittals shall include:

1. Submit product data sheets for all equipment being provided.

2. Collate in sequence by Section Number, and clearly mark proposed product on data sheet. Include Safety Data Sheet, where applicable.

3. Clearly identify any proposed product substitutions or known deviations.

E. Precede each submittal book with a summary TOC. per example schedule below:

1. Specification Section

2. Drawing Reference

3. Manufacturers Model No.

F. The following is a general summary list of Submittal items required to be delivered at 30-day burn-in period.

1. As part of project close-out activities, Contractor shall submit Record Documents for review and approval by the Owner.

2. All Record Documents shall be provided electronically in PDF format. All Record Document Drawings shall be provided in PDF and AutoCAD (latest version) DWG format.

1.10 CLOSEOUT SUBMITTALS

A. Contractor shall submit the following items:

1. Record As-Built Shop Drawings indicating the final, 'as-built' condition of all associated equipment, infrastructure, and work.

B. Shop Drawing Submittals shall include:

1. Drawing index/symbol/schedule sheet.
2. Clearly indicate all new work versus existing work.
3. Site Plans, Floor Plans, and Reflected Ceiling (work 7' AFF+) Plans
4. Drawings shall be developed in AutoCAD .DWG format, utilizing most current architectural backgrounds available for the project.
5. All drawings shall be properly scaled.
6. Indicate all device locations and types. Include addressing for all network outlets (as
7. Indicate all cabling routes, types and quantities.
8. Indicate all conduit routing, quantities, sizes, and wire fill. Indicate basket tray and J-hook routes.
9. Indicate fire stopping requirements for all penetrations.
10. Indicate 'cable bundle groups' no larger than:
    a. CAT5e – 52
    b. CAT6 – 64
    c. CAT6A – 74
11. When bundling low voltage cabling together the lowest common denominator determines the largest cable group allowed unless the cable is LP listed.

C. Riser Diagrams indicating:

1. Backbone cabling and termination locations. Associated cabling pathways, sizes and cable fill. Telecommunications Grounding System.

D. Enlarged Room Plans and Elevations indicating:

E. Provide dimensioned drawings for all telecommunications rooms. Complete, dimensioned rack and wall elevations of all equipment. Consideration must be given to equipment heights within. Plywood backboards and grounding equipment.

F. Racks, cabinets, cable tray, ladder rack, wire management. Termination equipment for all copper and fiber cabling. Conduit and cable entrance points and fire stopping. Electrical panels, power circuits and HVAC provisions.

G. Ensure coordinated arrangement of equipment with other trades. Typical Device Installation Details indicating: J-hooks, conduit, cable tray, and associated support systems. Network outlet faceplate layout and wiring terminations. Device back box and conduit rough-in requirements.

H. Details of other associated devices and equipment.

I. The shop drawing package must be stamped and signed by a Registered Communications Distribution Designer (RCDD). Signatures by a Professional Engineer (PE) licensed in the project jurisdiction for work of this type as required by the AHJ.

J. Cable Certification Test Results. Submit electronically and include associated software license as applicable.

K. Completed punch list reports.

L. Manufacturer Operation and Maintenance (O&M) Manuals.

M. Warranty information.

N. Keys and any portable equipment.

1.11 WARRANTY SERVICE

A. Closeout Submittals, Warranties and Guarantees, provide the following.

1. Response Time: Provide a qualified technician familiar with the work at the project site within four hours after receipt of a notice of malfunction. Provide the Owner's Representative with telephone number attended 10 hours a day, five days a week, to be called in the event of a malfunction.

2. Provide all Warrantees as defined in each Communication Systems Section.

B. PanGen Structured Cabling Solutions System Warranty

1. Contractor shall provide a Panduit Certification Plus System Warranty on all installed copper and fiber permanent links. Such warranty shall provide a complete system warranty to guarantee high end-to-end performance for all applications designed to operate over the class of cabling installed. The guarantee shall include all connectivity components and cable within the permanent link and cover the system for duration of 25 years.

PART 2 - MATERIALS

2.1 COMMUNICATIONS SYSTEMS PRODUCTS SUMMARY

A. The following is a general summary list of Communications Systems equipment, components, and cabling required for the project. This is not intended to be a comprehensive list of materials. See additional Sections for complete materials requirements.

B. Racks: Cooper B-line SB85219096FB (seismic). Standard racks shall be B-Line SB556096XUFB. Racks will be eight foot for new builds and remodels where space is available. Seven-foot racks will be used as an alternate where space is not available for taller racks.

C. Wire Managers: Panduit PE2V Series full height vertical cable manager.

1. 10" Wide Front/Back unless otherwise noted on plans

2. 96 inch or 84 inch sized to match the racks being installed.

D. Telecommunications Ground Bar (TGB) CPI_Mfg.Part:40153-012

E. Data Patch Panels: Panduit CP48WSBLY

F. Fiber Terminations: LC

G. Modular Jack CAT6A

1. Panduit Mini-Com CJ6X88TGVL

2. Colored Icons as needed per UC service designation

3. Icons are Panduit PAN_CID(XX) (gray for cables in ceiling)

H. Copper cabling, Category 6A (Data)

1. High Speed, TIA Category 6A cabling, Plenum Rated
2. General Cable GenSpeed 6A Part No. 7141877 Purple
3. General Cable GenSpeed 6A Part No. 7151855 Purple
    a. Use of the improved Genspeed cable is dependent on availability. Do not default to this cable if lead times are excessive.

I. Copper cabling, Category 6A Shielded (Overhead Paging)
1. High Speed, TIA Category 6A Shielded cabling, Plenum Rated
2. General cable GenSpeed 6A Part No. 7131789

J. Telecommunications Outlets (Workstation side)
1. Modular Furniture Surface Mount Box, Black
2. Panduit CBXQxBL-A Where x =number of ports
3. Modular Surface Mount Box Attachment System - Mini-Com CBM-X magnetic
4. Modular Surface Mount Box Blank Insert - Panduit CMB(BL)

K. Faceplate (Workstation side)
1. Panduit Mini-Com Stainless Steel Faceplates Single Gang CFP {2,4,6} SY or Double Gang CFP {4,8,10} S-2GY
2. Faceplate Blank Insert – Panduit CMB(WH)

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS SPACES

A. Telecom Room (TR) minimum size 10' x 15'.

B. UC Davis Health Telecommunications Standards do not include provisions for AV, unless otherwise indicated in the Design Criteria for the project. IT will be cooperative in assessing some parameters as they interact with IT support systems.

C. Telecommunication Spaces are to use EZ-Path Fire-Rated Pathways systems for cabling access.

D. Provide 36" of working clearance in front and back of racks and electronic equipment.

E. A positive pressure type of HVAC system using hot and cold aisles.

F. Walls shall be covered with fire-resistant treated plywood, and all surfaces sealed to mitigate airborne dust.

G. IT uses a typical three-rack configuration with a B-line seismic for equipment and a standard 19" rack for cabling. Vertical wire management for planning shall be sized at 10" unless otherwise noted on the drawings.

H. Lighting shall be provided with a minimum of 500 lux (50 foot-candles) measured at any point in the TR, including 6 inches above the finished floor. Photometrics shall consider position of racks

and equipment and light fixtures shall be placed to prevent shadows between rows of equipment racks.

I. TR Floors shall be covered in VCT (Vinyl Composition Tile) or Epoxy. Sealed concrete is not acceptable.

3.2 RACK COMPONENTS AND ELEVATIONS

A. Owner will develop an equipment layout and rack elevation including the Telecom Room (TR) layouts. Typical components within the TR include, but not limited to:

1. Network Equipment

2. Fiber Termination Unit

3. UPS/ PDU I Power distribution

4. NM2/ NM4/ Horizontal wire management

5. VOIP Router/Voice Gateway

6. VOIP transition equipment

7. Voice cabling

8. Distribution Patch Panels

9. Clinical Engineering Equipment

10. Plug Pack Distribution

11. Camera NVR /Server

12. Nurse Call Devices

13. Overhead Paging Amplifier

B. See related Sections for materials provided by the Owner and those furnished by the Contractor.

3.3 EXAMINATION

A. Conditions: Verify conditions, provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Pathways: Verify that pathways and supporting devices, provided under other sections, are properly and permanently installed, and that temporary supports, devices, etc., have been removed.

C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, “true tape” the conduits to verify cabling distances.

3.4 FIELD QUALITY CONTROL

A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule.

B. Project Management: Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute

meeting agenda prior to and meeting notes after meetings in a format acceptable to the General Contractor.

C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the General Contractor. Issue schedule to General Contractor for approval. Prepare and issue updated schedules whenever there are modifications.

D. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

3.5 INSTALLATION

A. Conform to applicable federal, state and local codes, and telephone standards.

B. Attend one pre-construction meeting with the Owner to coordinate the requirements of the communications systems.

C. Coordinate the entire installation with the General Contractor, and their subcontractors, to meet the construction schedule. Include coordination meetings as required to fulfill this requirement.

D. Manufacturer's Instructions:

1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

E. Maintain jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

3.6 REPAIR/RESTORATION

A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.

B. Paint damaged areas to existing painted surfaces caused by Work.

C. Punch List:

1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.

2. Provide punch list to Owner for review prior to performing punch walk with Owner.

D. Re-Installation:

1. Make changes to adjust the system to optimum operation for final use. Make changes to the system such that any defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.

2. Repair defects prior to system acceptance.

E. Cleaning

1. Clean daily. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.

2. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.

3. Repair or replace damaged installed products.

4. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Legally dispose of debris.

3.7 DEMONSTRATION

A. On completion of the acceptance test, schedule a time convenient with the Owner or Owner's Representative for instruction in the configuration, operation, and maintenance of the system.

B. Provide 4 hours, minimum, of on-site orientation and training by a factory-trained representative. Document dates and times of training and submit a "sign in" sheet for individuals trained, as part of the close out documentation.

3.8 CERTIFICATION

A. Provide to Owner or Owner's Representative a written form of acceptance for signature. Corrections must be completed before Owner or Owner's Representative and Engineer will give acceptance.

END OF SECTION

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SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding of communications work, including but not limited to:

1. Cable shields, communications racks, cabinets and enclosures

1.2 SYSTEM DESCRIPTION

A. Provide telecommunications grounding system as described herein.

B. Except as otherwise indicated, the complete communications installation including the racks, cabinets, panels, cable tray, runway, lightning protectors cable shields and splice cases provided under the work of this project shall be completely and effectively grounded in accordance with all Code and Standards requirements, whether or not such connections are specifically shown or specified.

C. Resistance:

1. Resistance from the farthest ground bus through the ground electrode to earth shall not exceed 5 Ohms or the requirements of ANSI-J-STD-607-D-2019, whichever is more restrictive.

2. Resistance from Communications racks Buss ground to UFER ground must remain less than or equal to the electrical ground presented at A/C outlet for electronic equipment in the communications rack.

1.3 DEFINITIONS

A. Definitions as described in Section 27 05 00 shall apply to this section.

1.4 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 QUALITY ASSURANCE

A. Comply with Quality Assurance requirements of Section 27 05 00

B. Strictly adhere to all Telecommunications Industry Association (TIA) recommended installation practices when installing Bonding and Grounding.

C. Material and work specified herein shall comply with the applicable requirements of:

1. TIA-568-D: Commercial Building Telecommunications Wiring Standard

2. TIA-569-E: Commercial Building Standard for Telecommunications Pathways and Spaces

3. TIA-607-D: Commercial Building Grounding and Bonding Requirements for Telecommunications

4. ANSI/TIA– 606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.6 WARRANTY

A. Match warranty Section 27 05 00

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

A. The Telecommunications Grounding Bus bar provides a central ground attachment point for telecommunications bonding backbones, TR equipment, racks, cable runways, sleeves, and

other system located in the Telecommunications Room. All Grounding Bus bars shall be UL listed. Hole patterns on Bus bars accommodate two-hole lugs per the recommendation of BICSI and TIA-607 standards. Insulators electrically isolate Bus bars from the wall or other mounting surfaces.

B. Manufacturer:

1. CPI Mfg. Part: 40153-12

2. Or approved equal

2.2 GROUNDING AND BONDING CONDUCTORS

A. General purpose insulated: UL listed and code sized copper conductor, with dual rated THHN/THWN, insulation color identified green.

1. Cable jacket marking:

a. Must be legible and shall contain the following information: Manufacturer's name

b. Copper conductor gauge, UL listing

c. Cable jacket shall be green with black lettering

B. Telecommunications Bonding Backbone cable:

1. 3/0 AWG THHN/THWN CU- Must be UL listed.

C. Telecommunications Bonding Conductor:

1. Sizing of the telecommunications bonding conductor per ANSIJ-STD-607-D

2. Size TBCs as the greater of 6 AWG or based on length of run using 1000CM/linear foot.

TBB/GE linear length m (ft)	TBB/GE size (AWG)
less than 4 (13)	6
4 - 6 (14 - 20)	4
6 - 8 (20 - 26)	3
8 - 10 (26 - 33)	2
10 - 13 (33 - 44)	1
13 - 16 (44 - 52)	1/0
16 - 20 (52 - 66)	2/0
20 - 26 (67 -84)	3/0
26 - 32 (85 - 105)	4/0
32 - 38 (106 - 125)	250 kcmil
38 - 46 (126 -150)	300 kcmil

46 - 53 (151 - 175)	350 kcmil
53 - 76 (176 - 250)	500 kcmil
76 - 91 (251 - 300)	600 kcmil
Greater than 91 (301)	750 kcmil

D. Manufacturers:

1. General Cable

2. Harger Lightning & Grounding

3. Or approved equal

2.3 COMPRESSION CONNECTOR LUG

A. Long-barrel compression lugs shall be used on all ground wire. Copper alloy body.

1. Provide lug size to match conductor being terminated.

2. Provide 2-hole pattern lugs.

3. Provide each lug with silicon bronze hardware, including 2 bolts, 2 split lock washers and 2 nuts.

4. UL listed.

B. Manufacturer:

1. Panduit.

2. Harger Lightning & Grounding GECLBxxx (xxx depending on cable Size).

3. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the execution requirements of Section 27 05 00.

3.2 EXAMINATION

A. Examine existing Telecommunications Grounding Backbone system prior to the start of work within this section. The Telecommunications Contractor is solely responsible to ensure work proposed within this section is fully compatible, in the opinion of the Engineer, with the existing Telecommunications Grounding Backbone system.

3.3 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

A. Where required by the Specifications, grounding conductors shall be spliced together, connected to ground rods, or connected to structural steel using exothermic welds or high-pressure compression type connectors.

B. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Harger Lightning & Grounding, Cadweld, Thermoweld or approved equal. Each particular type of weld shall use a kit unique to that type of weld.

C. High-pressure compression type connectors shall be used for cable-to-cable connections. Connections shall be as manufactured by Thomas & Betts #53000 series, Burndy "Hy-Ground or approved equal.

3.4 GENERAL EXECUTION

A. Provide Grounding & Bonding according to the most restrictive requirements of ANSI-J-STD-607-B, California Electrical Code Article 250 and references therein and California Electrical Code Article 800.

1. In the event of conflicting requirements, California Electrical Code requirements shall prevail.

B. Contractor shall supply all materials required to furnish and install a complete functional telecommunications grounding system.

C. The grounding system shall be installed in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.

D. Point of connection:

1. Under Work of this Section, install a complete Telecommunications Grounding System, leaving only the physical connection between the TMGB and Building Service Entrance Ground for work under Division 26 Electrical.

E. Ground bar installation

1. The C-10 Contractor shall install a ground bar in each Telecom Room to which all ground wires, grounding terminal points within the room, and Telecommunications Bonding Backbone conductors will terminate.

F. Telecommunications Bonding Conductor:

1. Install TBCs in a manner that will protect them from physical and mechanical damage.

2. Routing:

a. Route TBCs in the shortest possible path, using right-angles for turns and routed parallel to building lines.

b. Utilize a minimum 1-foot bend radius.

3. At TMGB/TGBs:

a. Thoroughly clean non electrotin-plated busbar prior to fastening the conductors, bolts, or connectors to the busbar.

b. Attach lugs to busbar with appropriate size cadmium bronze bolt, flat washer and Belle-ville washer.

4. Torque connections.

G. Rack Bay & Overhead Cable Support Bonding

1. Rack Bay: Bond equipment racks, frames, frame bays, cabinets, server racks, and other similar support systems located within the same room or space as the TMGB/TGB to the busbar.

2. Overhead Cable Support:

a. Bond overhead runway located within the same room or space as the TMGB/TGB to the busbar.

b. Provide “grounding kit” (straps & connectors) to bond sections of cable runway for ground continuity. This requirement shall apply to sections of cable runway within a single communication room.

3.5 LABELING

A. General Requirements

1. Labeling, identifier assignment, and label colors shall conform to TIA/EIA-606-A Administration Standard and as approved by Owner’s Representative before installation.

2. Permanently label TBCs. Affix label as close as practical to each end of the conductor.

B. Label Format

1. Labels shall be permanent with machine-generated text; handwritten labels will not be accepted.

2. Labels on TBCs shall fully wrap around conductors with a self-laminating feature to provide permanent marking.

C. Identifier Assignment

1. Separate label fields of the identifier with a hyphen.

2. TBC:

a. First field: “TBC” (the bonding conductor type).

b. Second field: The room identity where TBC exists; for example: “B01-TDA”.

c. Third field: A unique sequential number; for example: “01”, “02”, etc.

d. Example: “TBC–B01-TDA–01”

3.6 RECORDS

A. Communication Bonding System records shall conform to TIA/EIA-606-C Administration Standards. Each component shall have as a minimum, the information as outlined in TIA/EIA-606-C.

3.7 ACCEPTANCE

A. Review bonding configuration after all cabling and equipment is installed for approval by project IOR representative.

END OF SECTION

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SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the provision of communications supports and cable hook system as described in this specification, including but not limited to:

1. Strut supports
2. Cable hooks (J-hooks)
3. Beam clamps
4. Concrete fasteners
5. Touch-up materials
6. Conduit supports
7. Equipment supports
8. Fastening hardware
9. Poke-through device

1.2 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of communications equipment specified for this project.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.3 SEISMIC REQUIREMENTS

A. Seismic design requirements criteria, as shown on all drawings related to the project, including architectural and structural, as defined below shall apply to all work defined within the following specification sections:

1. SECTION 27 05 00 COMMUNICATIONS HORIZONTAL CABLING
2. SECTION 27 05 26 GROUNDING AND BONDING OF COMMUNICATIONS SYSTEMS
3. SECTION 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
4. SECTION 27 11 16 COMMUNICATIONS CABINETS RACKS FRAMES AND ENCLOSURES
5. All support systems and termination apparatus associated with the telecommunications system.

B. Contractor to install seismic restraints for all telecommunications racks and UPS systems. In accordance with construction documents. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.

C. Installation according to engineered drawings and anchorage calculations provided by the structural engineer in accordance with California Code of Regulations, Title 24, 2007 California Building Code.

D. Supports for such items, including racks, conduit, cable trays and similar shall provide support, bracing, and anchorage, designed by the structural engineer in accordance with CBC Chapter 16A.

E. Supports to be sized to suit load and selected to match mounting conditions

1.4 REFERENCES

A. Comply with References requirements of Section 27 05 00

B. In additional to those codes, standards, etc., listed in Section 27 05 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ASTM A 510 Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
2. ASTM B 633 Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
3. ASTM A 653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process.
4. ASTM A 591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.
5. ASTM A 123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

1.5 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.6 DEFINITIONS

A. Definitions as described in Section 27 05 00 shall apply to this section.

B. “Cable Hanger”: A metal, most often steel, cable support device shaped (section view) similar to the letter J; alternately, a fabric strap. The device is available in different sizes supporting different quantities of cables and is also available with different attachment hardware to be supported by different methods (e.g., wire support, beam flange clip, etc.).

C. Cable Runway or Ladder Rack: Overhead means to get cabling from point to point whether it be vertical or horizontal within Telecommunications Spaces such as TR’s and the TER.

D. “J-Hook”: Another name for cable hangers.

PART 2 - PRODUCTS

2.1 FASTENERS, STRAPS, AND BEAM CLAMPS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:

1. Concrete fasteners
    a. Hilti.
    b. Phillips "Red-Head."
    c. Remington.
    d. Ramset.
    e. Simpson Strong-Tie.
    f. Or approved equal.
2. Concrete inserts and construction channel:
    a. Unistrut Corp.
    b. GS Metals "Globe Strut."
    c. Thomas & Betts.

d. "Kindorf" Corp.

e. Or approved equal.

3. Conduit straps:
    a. 0-Z/Gedney.
    b. Erico "caddy" Fastening Products.
    c. Thomas & Betts.
    d. "Kindorf" Corp.
    e. Or approved equal.
4. Beam Clamps
    a. Cooper B-line.
    b. SuperStrut.
    c. Unistrut.
    d. Or approved equal.

2.2 CABLE HANGERS

A. Ceiling Hung J-Hooks

1. Specifically intended to carry the load of up to 74 communications cables without applying excess forces to cables at bottom of bundle.
2. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8" cable bearing surface.
3. Integral hanger rod attachment hardware at top. Load rated for application.
4. Incorporates smooth 90-degree radius edges to prevent snagging cable jackets on installation.
5. Designed so the mounting hardware is recessed to prevent cable damage.
6. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
7. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc.to meet job conditions.
8. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
9. Finishes: cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
10. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.
11. Manufacturer:
    a. Cooper B-Line series BCH21, BCH32, BCH64.
    b. Caddy/Erico cablecat.
    c. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the Executive requirements of Section 27 05 00.

3.2 EXAMINATION

A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Notify the University's Representative of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Installer is responsible for the integrity of the structures to which the system is attached, including their capability of safely accepting the loads imposed as evaluated by a qualified engineer.

C. The University's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the University.

3.3 PREPARATION

A. Prepare and maintain the following clearances from EMI sources (per BICSI Standards).

1. Power cable (in grounded conduit) = 6 inches
2. Power cable (unshielded) = 24 inches
3. Fluorescent lights = 5 inches
4. Transformers = 48 inches

B. Provide all low voltage Communications Systems Pathways and Electronic Security and Safety System Pathways.

3.4 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS)

A. The cabling support system shall be installed in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.

B. Provide dedicated supports at sixty inches (60") separation, maximum, per a given route. Suspend wire or rod using components appropriate for the structure – e.g., powder-actuated clip fastener for wire, beam flange clip or angled flange clip for either wire or rod, or an embedded anchor for the threaded rod. Do not share support (wire/rod) with other trades. Do not support the hanger on ceiling grid support wires. Do not support the hanger from ductwork, piping, or other equipment hangers.

C. Cable Tray cables are not to exceed a 25% fill when the project is complete. 25% fill is a visual fill of 50% of the cable tray.

3.5 CONDUIT

A. Conduit used for pathway is to be designed with a maximum 40% visual fill.

B. EZ path retrofit EZDR-400 or EZDR-200 will be provided on all conduits when required for compliance.

3.6 FLOOR BOXES AND POKE THROUGH DEVICES

A. All Floor boxes shall be sized and approved by UCD IT and FD&C's furniture group.

1. Wiremold RC9AM2TCBK flush poke -thru with accessories as required.
2. One 1-1/4" trade standard, data.
3. One 1-1/2" trade standard, av or other.
4. Floor poke through assembly, dual service feed-through fitting. Commonly used wire mold RC9AM2TCBK flush poke -thru with accessories as required. One 3/4" trade standard and one 1-1/4" trade standard.
5. Wiremold 4ffatcbs flush furniture feed poke -thru with accessories as required.
6. Or approved equal.

END OF SECTION

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SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide telecommunications pathways in accordance with ANSI TIA-569-E, as shown on the plans or as designed by an RCDD.

B. Provide conduits as required by fire code and where wall cavities are obstructed.

C. Provide Ring and String where allowed in wall cavities and locations are accessible.

D. Provide a minimum of a 1 ¼" conduit for wall drops as needed.

E. All junction boxes shall be sized and designed by a registered RCDD communications designer

F. Conduit for communications is NOT to adhere to the parallel of the exterior wall configuration required by the electrical specification. Cable Distance is priority for communications cabling and dictates path taken.

1.2 RELATED SECTIONS

A.	27 05 00	COMMON WORK RESULTS FOR COMMUNICATIONS
B.	27 05 26	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
C.	27 05 29	HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
D.	27 05 36	CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
E.	27 05 53	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
F.	27 11 16	COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
G.	27 11 19	COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
H.	27 11 23	COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
I.	27 11 26	COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
J.	27 13 00	COMMUNICATIONS BACKBONE CABLING
K.	27 13 43	COMMUNICATIONS SERVICES CABLING
L.	27 15 00	COMMUNICATIONS HORIZONTAL CABLING
M.	27 41 33	MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Submittals are to be approved by IT Facilities Department and consultant.

1. Obtain written approval from the Consultant for the product data submittal prior to materials and equipment purchase order and prior to installation.

2. Format: Submit each product data as an electronic (PDF) document.

3. Labeling: For each submittal, provide a cover page including the following information:

a. Client Name

b. Project Name and Address

c. Submittal Name (e.g., “Product Data Submittal for LCD Panel Backbox.”)

d. Specification Section Number (e.g., “Section 27 05 33).

e. Date of Submittal

f. Contractor Name

C. Submit conduit shop drawings for cable path other than wall drops.

D. Confirm low voltage pathway quantity and fill ratio expected.

E. Include junction box locations and sizes.

PART 2 - PRODUCTS

2.1 WORK AREA OUTLET BOX

A. Work area outlet box

1. 4 11/16” x 2 1/8” deep boxes on wall drops where required

2.2 JUNCTION BOXES

A. Junction Boxes

1. Sized to accommodate bend radius of cabling being installed.

2.3 FLOOR BOXES, POKE-THROUGHS AND MONUMENTS

A. Floor Box, Flush Devices

1. All Floor boxes shall be sized and approved by IT facilities and FD&C's furniture group.

2. Manufacturers

a. Wiremold RC9AM2TCBK Flush Poke -Thru with accessories as required.

B. Floor Poke Through Assembly, dual service feed-through fitting.

1. Commonly used

a. Wiremold RC9AM2TCBK Flush Poke -Thru with accessories as required.
1) One 3/4" trade standard
2) One 1-1/4" trade standard

b. Wiremold 4FFATCBS Flush Furniture Feed Poke -Thru with accessories as required.

2.4 WIRELESS, SECURITY AND OTHER PERIPHERAL CABLING INSTALLATIONS

A. Conduit and/or electrical outlet box shall not be installed for wireless access point installations unless required by AHJ or physical conditions of the area.

B. Consider the device being installed when calling out conduit and housings for security and peripheral devices due to differing requirements.

2.5 FIRE PENETRATIONS

A. EZ path retrofit EZDR-400 shall be provided where applicable as fire stop materials on all conduits.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Distribution Pathway via EMT Raceway:

1. Structured cabling installation is to meet BICSI cable distance limitations. Remaining parallel to the building structure is not a requirement.

2. All ends of conduits shall be cut square, reamed and fitted with insulated bushing.

3. All conduit which passes through firewalls shall adhere to applicable fire code.

3.2 PREPARATION

A. Fill ratios are to be calculated by the designer and installer during their respective design and installation phases of the project.

B. Cable Tray cables are not to exceed a 25% fill when the project is complete. 25% fill is a visual fill of 50% of the cable tray.

C. Conduit used for pathway is to be designed with a maximum 40% visual fill.

D. EZ path retrofit EZDR-400 or EZDR-200 will be provided on all conduits when required for compliance.

3.3 MOUNTING AND INSTALLATION – WORK AREA OUTLET BOX

A. Provide back boxes at all wall phones and employee time clocks.

B. The distance between pull boxes shall not exceed 100 feet.

C. Conduits exceeding two 90-degree bends shall be upsized to the next trade size and never exceed 240 degrees.

D. Support and fasten pathway and pull boxes as defined in the electrical specifications.

E. Conduit purposed for floor box(es) must have the respective conduit turn up in an adjacent or nearby wall or column that is stubbed to nearest accessible ceiling.

F. Manufacturer's instructions:

1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

2. Maintain jobsite file of Material Safety Data Sheets (MSDS) for each product delivered to jobsite packaged with an MSDS.

3.4 PENETRATIONS

A. Provide EZ path fire penetrations where applicable.

B. Provide conduit penetrations per electrical Specifications.

3.5 STATION CABLE PATHWAY INSTALLATION

A. Work Area Outlet Boxes:

1. Unless otherwise noted on the plans, all cut in boxes and surface station outlet boxes are to be installed at a height of 18" A.F.F. (above finished floor) to center, except for those otherwise called out.

2. Those plates or boxes that are to be used for telephone wall jacks shall be installed according to ADA requirements.

3. All cabling outlets shall be installed so that their edges are parallel to the vertical and horizontal edges of the surface on which they are mounted.

3.6 FINAL INSPECTION AND CERTIFICATION

A. Punch Walks and Punch Lists

1. Punching the Work of individual Sections of Division 27 may be combined.

2. Execute a punch walk with the Consultant to observe work.

3. Develop a punch list for items needing correction. Issue this punch list to Consultant.

4. Correct the Work as noted on punch list.

5. Execute follow up punch walk with the Engineer and the Owner or Owner's Representative to verify punch list items have been corrected.

END OF SECTION

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SECTION 27 05 41
FIRE-STOPPING SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: Firestopping for the following.

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Comply with California Code of Regulations - Title 24, CBC - Chapter 7, Fire Resistance Ratings and Fire Tests.

B. Test Requirements:

1. ANSI/UL 2079 Tests for Fire Resistance of Building Joint Systems, 2020

2. ASTM E-814 Standard Test Method for Fire Tests of Penetration Firestop Systems, 2017

3. ANSI/UL 1479 Standard for Fire Tests of Penetration Firestops, 2015

1.3 RELATED SECTIONS

A. Division 27 Communications Sections

1.4 SUBMITTALS

A. Procedure: In accordance with Division 01 and the following:

B. Data: Manufacturer product data, including UL Listing, for all materials and prefabricated devices and manufacturer's installation instructions. Submitted material must be approved by Campus Fire Marshal prior to installation.

C. Shop drawings detailing location of installed through penetration devices.

1.5 QUALITY ASSURANCE

A. Compatibility: Provide firestop systems compatible with one another and with substrates under conditions of application and service.

B. Firestop system installation, must meet requirements of ASTM E-814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. All materials shall be new.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following, as required by condition of use:

1. Specified Technologies, Inc.
Somerville, NJ, telephone 800-992-1180

2.2 MATERIALS

A. All through penetrations shall be labeled on both sides of the wall to indicate the appropriate UL system number, product used, installation date, hour rating installer, location number and telephone contact for the corresponding manufacturer. Material installed shall be as required for installation conditions and to achieve the required fire resistance.

B. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

C. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:

1. EZ-Path retrofit device sized for the conduit being installed.

D. For penetrations by combustible items (penetrants consumed by high heat aflame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:

1. EZ-Path Fire Rated Pathway

E. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways the following materials are acceptable:

1. EZ-Path Fire Rated Pathway

F. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E-814 which is equal to the time rating of construction being penetrated.

G. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

H. For work station conduits from accessible ceiling to outlet.

1. STI SpecSeal putty.

I. For pipe penetrations of cast in place concrete floors and concrete over metal decking the following material is acceptable:

1. EZ-Path

PART 3 – EXECUTION

3.1 PREPARATION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.2 INSTALLATION

A. Install materials in compliance with their manufacturer's instructions and the printed instructions of UL Fire Resistance Directory.

B. Install re-enterable, non-hardening, intumescent putty in work station conduits where required. Do not use fire caulk.

3.3 IDENTIFICATION

A. Identify firestopping with pressure sensitive, self adhesive preprinted labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping installation where the labels will be visible to anyone seeking to remove penetrating items or firestopping. Include the following information on the labels:

1. The words: "WARNING—FIRESTOPPING—DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE”
2. Contractor's name, address and phone number
3. Firestopping system designation of applicable testing and inspecting agency
4. Date of installation
5. Firestopping manufacturer's name
6. Installer's name

END OF SECTION

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SECTION 27 05 53
IDENTIFICATION AND LABELING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling for items including but not limited to communications cabling (structured and non-structured) innerduct, connectors, faceplates, jacks, receptacles, patch panels, and racks.

B. All labels will be preprinted, or computer printed type. Handwritten labels are not acceptable

C. This section includes minimum labeling requirements for the following:

1. Room designations

2. Communications cabling

3. Closet Hardware including patch panels, terminal blocks, protectors and racks

4. Work Area Outlets

5. Wireless Access Points

6. Pathways and Spaces

7. Grounding and Bonding

1.2 VISUAL APPEARANCE

A. Clear plastic covers over faceplate labels are not permitted.

B. Shall be preprinted or computer printed type.

C. Black SMB's are to be labeled with white on black.

D. Stainless will be labeled with black on white.

E. White (if required) will be labeled with black on white.

1.3 LABELING STANDARDS AND REQUIREMENTS

A. All new labeling is to reflect UCD labeling standards.

B. Contact the University's Representative for a copy of the current standards prior to proceeding.

C. Bring to the University Representative’s attention any project conditions not described in these specifications and the University's current standards and conform to the direction received.

D. Identification and administration work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

1.4 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

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Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

PART 2 - PRODUCTS

2.1 COMMUNICATION CABLING LABELS, GENERAL

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Handwritten labels are not acceptable.

2.2 COMMUNICATION CABLING LABELS, INTERIOR

A. Provide vinyl substrate with a white printing area and black print.

B. If cable jacket is white, provide cable label with printing area which is either orange or yellow, such that the labels are easily distinguishable.

C. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.

D. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

E. Manufacturers:

1. Cable Type- 4 pair UTP /4 pair UTP Zero Skew - Panduit S100X125VAC or approved equal.

2. Cable Type- 4 pair STP - Panduit S100X125VAC or approved equal.

3. Cable Type- 25 to 100 pair copper - Panduit S100X650VAC or approved equal.

4. Cable Type- 2 strand fiber - Panduit F100X300AJT or approved equal.

5. Cable Type- 4-12 strand fiber - Panduit S100X125VAC or approved equal.

6. Cable Type- RG-6 and RG-59 Coax - Panduit S100X125VAC or approved equal.

7. Cable Bundles - Panduit UIHL12-XO or approved equal.

8. Other Interior Cabling - Panduit S100X650VAC or approved equal.

2.3 CLOSET HARDWARE LABELS

A. Shall meet the legibility, defacement, exposure, and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Handwritten labels are not acceptable.

C. Location ID:

1. Panduit - White C061X030FJC

2. Panduit - White C750XOSOYIJ

3. Or approved equal.

D. Non-keystone-based fiber patch panels:

1. Panduit - White C061X030FJC

2. Panduit - White C750XOSOYIJ

3. Or approved equal.

E. 110 blocks

1. Panduit C750XOSOYIC

2. Panduit S White C750XOSOYIJ

3. Or approved equal.

2.4 GROUNDING AND BONDING, PATHWAY, AND SPACE LABELS

A. Panduit C200X100FJC or approved equal.

2.5 WORKSTATION LABELS

A. Panduit - White C061X030FJC

B. Panduit - White C750X050YIJ or approved equal.

2.6 LOCATION NAMEPLATES

A. Provide laminated plastic nameplates for each equipment enclosure, rack, switch, and device, as specified.

B. Comply with ASTM D 709.

C. Each nameplate inscription shall identify the function and, when applicable, the position.

D. Nameplates shall be melamine plastic, 0.125-inch thick, black with white center core.

E. Surface shall be matte finish. Corners shall be square.

F. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by three inches.

G. Lettering shall be a minimum of 0.25-inch-high normal block style for location nameplates or a minimum of 1-inch-high normal block style for rack nameplates.

H. Panduit C300X100APT or approved equal.

2.7 COMMUNICATION CABLING LABELS, OUTSIDE PLANT

A. Cable Tags in Manholes, Handholes, and Vaults

1. Provide tags for communications cable or wire located in manholes, handholes, and vaults.

a. The tags shall be polyethylene.

b. Machine printed - Do not provide handwritten letters.

2. Polyethylene Cable Tags

a. Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch) 3250 pounds per square inch; and that are two millimeter (0.08 inch) 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C 170 degrees F.

b. Provide 1.3 mm (0.05 inch) 0.05 inch (minimum) thick black polyethylene tag holder.

c. Provide a one-piece nylon, self-locking tie at each end of the cable tag.

d. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds) 175 pounds. The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) one inch high on a yellow background.

e. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

3. Manufacturers:

a. Panduit

b. Brady

c. Or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify all room numbers, racks, conduits, cable tray, cables, equipment housing, vaults and items within this document have been labeled.

B. Contractor applied labeling shall reflect final space and Telecommunications structure designations.

C. Accurate labeling shall be provided on the as-built shop drawing submittals.

3.2 IDENTIFICATION AND LABELING

A. Telecommunications Rooms

1. Labels shall be affixed at the entry to all telecommunications rooms and spaces (Includes entrance facilities, telecommunications equipment rooms, communication equipment spaces and work areas).

2. All IT rooms are numbered but not designated “equipment” due to security concerns.

B. Cable Tray and Conduits

1. Cable tray structured versus AV or analog systems pathway labeling and designations are the responsibility of the installer to designate the services that are to use the pathway or what portion of the pathway.

2. Any permanent label that is clearly visible is acceptable.

C. Rack and Cabinet Labeling

1. Provide laminated plastic nameplates for each equipment enclosure, row and rack designations as shown on elevations provided by UCD IT.

D. Copper Patch Panels – Horizontal

1. Label with Jack numbers.

E. Tie Cable Patch Panels

1. Label the pair count at the top of the patch panel, separated from all others.

2. Place the cable's identification text centered on the top label strip. (example:18CA75, TIE 1672A).

F. 110 Blocks

1. Not used other than MPOE, OSP installation.

2. Label with University provided designation.

G. Workstations

1. Use adhesive type labels and affix labels to faceplate per diagram provided.

2. Provide sequential 4 or (Occasionally 5 digit) jack number (starting dependent on the floor designation) beginning with an X such as X056, X being floor# followed by the closet sequenced cable number.

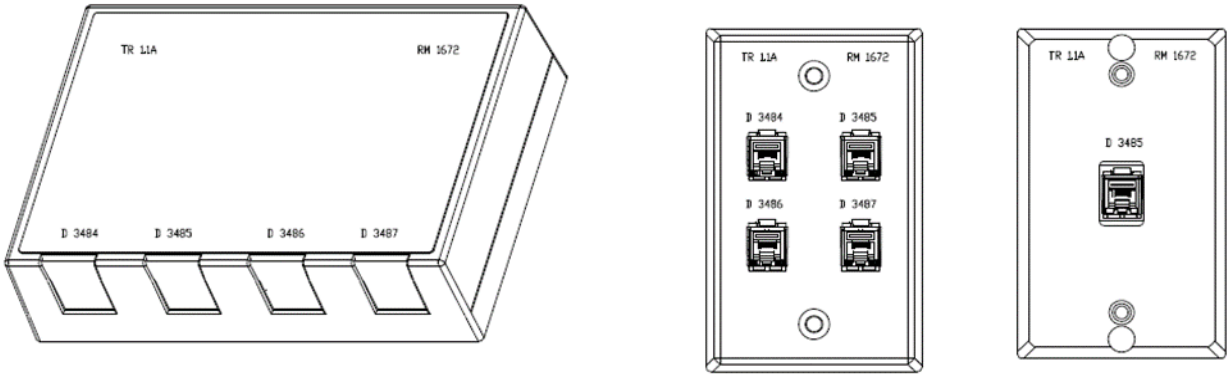
3. All faceplate labels shall contain the following items:

a. Building and Closet Designation such as 34-1100 (building#, IT closet#)

b. TR Designation such as TR1.1 or TR 1A (University established designation)

4. Under no circumstances are jacks to be installed with a drop/name or location number as a label or a matrix identifier.

5. See diagram below:



H. Wireless Access Point (WAP) Labeling

1. The University's Representative will provide locations for Wireless Access Point installations with the University's assigned designated identifiers adhered to the Access Point itself.

2. Building Designation / room or area designation – AP / a,b,c (if multiple AP's within room).

3. WAP labeling consists of the Icon being a designated color at the device, Icon being a designated color in the patch panel, and a band being installed on both ends of the patch cord that connects the cable in the TR room.

I. Grounding and Bonding

1. Label the TMGB (telecommunications main ground busbar) with an adhesive label.

2. Label the TGB(s) (telecommunications ground busbar) with an adhesive type label(s).

J. Other Cable Numbering

1. Other cabling types, such as Coax installed in a TR shall be numbered uniquely, such as C=Coax.

2. Cameras and AP's are Data Cabling, which falls into the Data Cabling labeling scheme.

3. Point to point Data Cables require independent numbering such as A1001 for items such as in room video distribution such as N-stream equipment.

K. Fiber Patch Panels

1. Fiber patch panels shall be marked using adhesive labels indicating the range of circuits installed to it. All fiber optic cable patch panels shall be labeled with the pair count of every fiber pair, the cable's assigned identifier, and the patch panel's assigned identifier.

2. All labels shall consist of the following:

a. Provide the respective FTU # next in sequence in the data room.

b. Provide and label each bulkhead in the fiber panel per the following: Fiber Cable #, "FROM" Building / "FROM" Room / "FROM" FTU / Fiber Type / Strand # to Location / Telecom Cable # / "TO" Building / "TO" Room / "TO" FTU / / Strand # / Fiber Type.

c. Coordinate with IT before applying any labels.

L. Fire stopping

1. Each fire stopping location shall be labeled at each location where fire stopping is installed, on each side of the penetrated fire barrier, within 12 in. of the fire stopping material.

2. Labels shall adhere to the requirements set forth by the authority having jurisdiction (AHJ).

M. Indoor Communications Cables

1. Horizontal and Indoor Backbone cables shall be marked within 12 inches of each endpoint or to innerduct in which the cable is installed.

2. Label each end of each riser cable where the cable terminates.

3. Backbone cables shall be marked at each endpoint and at all intermediate locations, pull/access point or junction boxes through which the cable passes, as well as on each floor and in each room the cable is openly visible in.

N. Copper Riser Cabling.

1. Label all copper backbone cables of at least 25 pair construction to contain the following information:

a. Installation Date

b. University Assigned Cable ID: (Example: 70 Tie 0P609).

O. Fiber Riser cabling.

1. Label all fiber backbone cables to contain the following information:

a. Installation Date

b. University Assigned cable ID:(Example: IFA134)

END OF SECTION

SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Equipment racks shall be Contractor furnished; Contractor installed.

B. The Owner standard is to provide 3 feet clearance from all rack and rack hardware to other hard surfaces in addition to allowing for code requirements for electrical power in the room. Some instances may require deviations due to room sizes and architectural features. Install racks according to construction documents. Report conflicts to IT before installation.

1.2 PREPARATION

A. Verify that no mechanical, electrical or other systems and piping systems, (e.g. water sources) run through the TR Rooms or IT spaces

B. Receive approved layout from Owner IT.

C. Validate the package for the IT installation, e.g. power for equipment, pathway for cabling air conditioning and incidentals for proper operation of each TR.

1.3 EQUIPMENT MOUNTING

A. All floor supported equipment racks shall be bolted to the structure in accordance with the requirements of the CBC.

B. Contractor shall install per approved structural engineering design illustrating the materials approved that conform to these requirements.

1.4 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Seismic Racks

1. Cooper B-line SB85219096FB

a. Eight-foot for new builds and remodels where space is permits.

b. Seven-foot racks will be used as an alternate where space is not available for taller racks. Coordinate rack requirements with the owner.

B. Standard Racks

1. B-Line SB556096XUFB

a. Eight-foot for new builds and remodels where space permits.

b. Seven-foot racks will be used as an alternate where space is not available for taller racks. Coordinate rack requirements with the owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Free-standing Universal Racks

1. Assemble relay racks according to manufacturer’s instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

2. Racks and cabinets must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.

3. Racks and cabinets shall be grounded to the TGB and or TMGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).

4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.

5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

7. Install per approved structural requirements as defined by the project structural review.

END OF SECTION

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SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install copper termination assemblies, including rack and cabinet mounted copper patch panels.

B. Furnish and install fiber termination assemblies, including:

1. Fiber connectors

2. Rack and cabinet mounted fiber patch panels

1.2 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS

A. Provide product data for the following:

1. Manufacturer's data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).

1.4 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all BICSI, and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.5 WARRANTY

A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.

B. Authorized Installer/Authorized Integrator shall provide labor, materials, and documentation in accordance with Panduit requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.

C. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.

PART 2 - PRODUCTS

2.1 COPPER CABLE TERMINATION DEVICES AND RELATED

A. Copper patch panels

1. Rack mount category 6A 8P8C

2. Panduit CP48WSBLY

3. Or approved equal.

2.2 FIBER CABLE TERMINATION

A. Fiber Optic Connectors

1. Connectors are fusion splice termination style.

2. Provide fusion splice to factory assembly including fiber pig tail & connector

3. Insertion loss for multi-mode ≤ 0.03 dB - manufacturer's rating for typical splice.

4. Insertion loss for single mode ≤ 0.06 dB - manufacturer's rating for typical splice.

5. LC at rack mounted patch panels as noted or scheduled,

6. Use Corning Cable Systems model X77 Micro Fusion Splicer, Fujikura fusion splicer, or equal.

B.

C. Utilize a precision zirconia ceramic ferrule.

D. Shall have a radial-ramped coupling nut, which facilitates mating/de-mating.

E. Connector performance per TIA-568.C.3 and the following:

1. Insertion Loss, multimode: Less than or equal to 0.75 dB per mated pair.

2. Insertion Loss, single mode: Less than or equal to 0.50 dB per mated pair

3. Insertion Loss: single mode, angle polish: Less than or equal to 0.30 dB per mated pair

4. Return Loss: single mode, Ultra Polish, greater than or equal to 55 dB

5. Return Loss: single mode, Angle Polish, greater than or equal to 65 dB

F. Fusion Spliced LC Multimode matching to the fiber type being terminated.

G. Fusion Spliced LC Single Mode matching the fiber type being terminated.

2.3 FIBER DISTRIBUTION PANELS

A. Fiber Termination Unit

1. AFL rack mounted fiber housing with LC connector panels sized accordingly.

2. Provide manufacturer's blank cover inserts at unused openings.

PART 3 - EXECUTION

3.1 GENERAL

A. The contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.

B. Contractor shall have a minimum of five (5) years of recent experience on structured cabling systems of similar type, size and quantities.

C. Cable termination:

1. Route cables in Telecom Rooms to patch panels in racks by routing across cable runway to top of rack and then down vertical cable management sections to back of patch panels or termination locations.

2. Route cables in Telecom Rooms to wall mount cabinets and down through openings of top and/or bottom of cabinets to patch panels. Cabinet standoffs may be used to create additional and necessary pathway.

3. Cables and Termination Hardware: Test 100 percent for defects in installation and verify cabling system performance under installed conditions.

a. Verify all pairs of each installed cable before system acceptance.

b. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

4. Cables, Jacks, Connecting Blocks, and Patch Panels:

a. Verify all pairs of each installed cable before system acceptance.

b. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

END OF SECTION

SECTION 27 11 23
COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes provision of cable management for cabling installed under the work of this Project.

B. Install plywood to surround each TR room to support systems and cable management.

C. Install ladder racking.

D. Install CFCI racks and vertical wire managers to support cable management and supporting systems within the room.

E. Contractor to furnish and install patch panels.

F. Contractor to furnish and horizontal cable management.

G. Install conduit, fire penetrations, and cable pathway suitable to support and manage the installation of fiber and copper data infrastructure per BICSI standards.

H. Ensure proper maximum fill ratios for all pathways. Do not overfill pathways.

I. Ensure proper EMI separation.

J. Install innerduct where required.

1.2 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

PART 2 - PRODUCTS

2.1 BACKBOARD CABLE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

A. ¾ inch x 48” x 84 “ A/C grade, fire rated, painted plywood installed on perimeter of the room.

1. Plywood will be painted with an approved fire-retardant paint compliant with APWA and CSFM/CBC standards.

2. Fire rating labels on plywood will be covered with masking tape before painting and later removed to allow for inspection before turnover.

2.2 INNERDUCT (CONTRACTOR FURNISHED AND INSTALLED)

A. Interior (non-plenum)

1. Carlon Optic-Gard/PVC.

2. Arnco.

B. Interior (plenum)

1. Carlon Plenum-Gard.

2. Arnco.

2.3 CONDUIT SPILLWAY (CONTRACTOR FURNISHED AND INSTALLED)

A. For conduit transitions.

B. Constructed of fire-retardant ABS.

1. Panduit CWF400 or equal.

2.4 CABLE TRAY WATERFALL (CONTRACTOR FURNISHED AND INSTALLED)

A. Provide cable tray waterfall or drop out at ends of all runs.

1. Cooper B-line 9A-1104.

2. Cooper B-line 99-1124.

3. Or approved equal.

2.5 CABLE TRAY TRANSITIONS (CONTRACTOR FURNISHED AND INSTALLED)

A. All turns, bends, and direction changes shall use manufacturer's pre-manufactured materials.

B. Vented trough engineered rounded transitions such as Cooper B-line 4AVT-12-90-HB-24 shall be accepted.

2.6 CABLE TRAY DIVIDER (CONTRACTOR FURNISHED AND INSTALLED)

A. Provide where separation is required between conductors routed in the same tray.

1. 73A-90HBFL.

2. Or approved equal.

2.7 BASKET TRAY WATERFALL (CONTRACTOR FURNISHED AND INSTALLED)

A. Provide cable tray water fall at all tray ends and side cuts.

B. Provide drop out at center cuts.

1. Panduit WGBTMWFBL.

2. Panduit WGSDWWF4BL.

3. B-line WB06-DO (8 or 12).

2.8 BASKET TRAY RAIL RISER (CONTRACTOR FURNISHED AND INSTALLED)

A. WB2RR or equal.

2.9 BASKET TRAY DIVIDER (CONTRACTOR FURNISHED AND INSTALLED)

A. WB2B-3M or equal.

2.10 J HOOK CABLE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

A. Provide and install according to Section 27 05 29.

2.11 HORIZONTAL WIRE MANAGER (CONTRACTOR FURNISHED AND INSTALLED)

A. Install 2 or 4 RU assembly as indicated in Owner provided rack elevations.

B. Panduit NM2 or NMF4 as shown on IT rack elevation drawings.

2.12 VERTICAL WIRE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

A. High density vertical wire manager to accommodate fiber and copper cross connecting patching cables in addition to providing power distribution power strip mounting surfaces and space.

B. Contractor installed; refer to Owner provided rack elevation drawings for placement.

1. Install according to construction documents.

2. Do not put large sweeps or service loops in vertical cable managers.

PART 3 - EXECUTION

3.1 GENERAL EXECUTION - PREPARATION

A. OWNER IT is responsible for preliminary layout of the telecommunications room and shall provide requirements to Construction Team for the production of shop drawings.

B. The cabling contractor in addition to the engineer is responsible for managing cable quantities and validation of the pathways provided for fill ratio and placement to ensure cable length and capacities are according to Owner requirements. If a determination is made that the pathway is deficient, the contractor shall construct additional pathways accordingly.

C. Install products, components, accessories, hardware, etc., according to the manufacturer's instructions. Do not put service loops in vertical wire managers.

D. The contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.

3.2 PATHWAY CABLE MANAGEMENT

A. Provide a comprehensive cable management system complete with all accessories including radius corners at vertical and horizontal bends, section splice plates, expansion plates, blind-end plates, etc.

B. Cable Tray/Basket Tray Cable Management

1. Do NOT Tie Wrap cables.

2. Do NOT Secure cables to cable tray unless required to hold in place.

a. Cable shall not be attached to the cable tray (i.e. cable shall be left "loose")

3. For performance reasons, station cabling in tray shall not be combed.

4. Cable shall be laid in tray or ladder rack in such a way as to present a neat and professional appearance.

C. Ladder Rack Cable Management

1. Do NOT Tie Wrap cables.

2. Do NOT Secure cables to cable tray unless required to hold in place.

a. Cable shall not be attached to the cable tray (i.e. cable shall be left “loose”).

3. For performance reasons, station cabling in tray shall not be combed.

4. Cable shall be laid in tray or ladder rack in such a way as to present a neat and professional appearance.

D. J HOOK Cable Management

1. Cables are to be consistently grouped together with like systems cabling (Fiber/AV/ Copper/Feeder, Etc.

2. Suspended cable runs (J-Hooks) shall be supported at intervals not exceeding every 5’. Cable installed on exposed surfaces or structural members shall be installed parallel and perpendicular to the surfaces unless a cable distance limitation arises. Cable distance and remaining within cable distance limits shall take priority. Surface contours shall be followed wherever possible.

3. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable unless approved by the AHJ

4. Cabling installed in J-Hooks or Stiffy’s, shall not have a deflection of more than 3”, as identified in the cable support details, in the drawings.

3.3 EXAMINATION AND ACCEPTANCE

A. Perform walk thru with Owner representative to validate cable separation, cable routes and fill ratios.

END OF SECTION

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SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Building IT UPS. Three phase.

1. All IT equipment in the IT room shall be serviced (unless prohibited by code) by the IT UPS. A single efficient building UPS is the goal of IT to minimize UPS size and optimize maintenance. (Contractor Furnished, Contractor Installed)

B. Single phase IT UPS systems up to 10 KVA (Owner Furnished, Owner Installed)

C. 208 Volt power provided to the IT UPS systems, 10 KVA, 6 KVA, or three phase unit, Contractor Furnished Contractor Installed.

D. 110 Volt power provided to the IT UPS system 3 KVA, contractor furnished, and contractor installed.

E. Power Distribution from the three phase IT UPS power distribution panel to each outlet, Contractor Furnished and Contractor Installed.

F. Turn up, test and certification provided by Owner.

G. Installation of Power Strips in Cabinets and Racks are Owner Furnished Owner Installed.

1.2 REFERENCES

A. ANSI/TIA-569-E Telecommunications Pathways and Spaces, 2019

B. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises, 2015

C. ANSI/TIA – 568.1-D Commercial Building Telecommunications Cabling Standard, 2015.

D. ANSI/TIA-942-B Telecommunications Infrastructure Standard for Data Centers, 2017.

E. ANSI/TIA – 606-C Administration Standard for Telecommunications Infrastructure, 2017.

F. ANSI/TIA – 607-D Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises, 2019.

G. ANSI/TIA-862-B Structured Cabling Infrastructure Standard for Intelligent Building Systems, 2016

H. California Electrical Code (CEC).

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for rack-mounted power protection and power strips.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include workspace requirements and access for cable connections.

3. Grounding: Indicate any chassis bonding requirements.

4. Network Connection and Programming: Indicate networking and configuration requirements and connections.

1.4 QUALITY ASSURANCE

A. Product Certifications: UL & CUL 62368; IEC 62368; CE; FCC Part 15, Class A; EN 55022 and RoHS Compliant

1.5 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

I. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

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K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

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1.6 SEQUENCING

A. Coordinate with Construction management and Owner representative. A 30-Day burn in is required for electronic equipment.

1.7 PREPARATION

A. Verify that no piping systems, (e.g., water sources) run through or above the UPS location.

B. Provide shop drawings indicating locations and sizes of UPS systems to receive approval of IT Facilities.

1.8 EMERGENCY POWER

A. Provide two (2) separate emergency distribution systems from two (2) ATS designed “Life Safety System” and “Equipment System” where available.

1.9 POWER NON-HOSPITAL (LEASED ADMIN)

A. Provide two (2) separate distribution systems from two diverse panels.

B. Where available backup generator service shall provide service to UPS equipment.

C. Owner required emergency power loads such as IT systems shall be placed on the “Equipment System” (Load shedding provisions).

PART 2 - PRODUCTS

2.1 UNINTERRUPTABLE POWER SUPPLIES

A. Liebert UPS

2.2 GENERAL

A. A bypass circuit shall be provided as an integral part of the UPS. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarms conditions. This control circuit shall provide a transfer of the load to the bypass source if available and if the inverter is capable of powering the load (i.e., if there is an overload condition, if the unit is in Manual Bypass Mode or if the voltage or frequency is out of tolerance).

1. Automatic Transfers

2.3 BYPASS

A. The transfer control logic shall activate the bypass automatically, transferring the critical AC load to the bypass source, shall be provided when applicable.

B. COMMUNICATION OPTIONS

1. Liebert IntelliSlot Communications

C. The UPS shall include one Liebert IntelliSlot communication port to allow the operator to field-install an optional Liebert IntelliSlot communication card. A Liebert IntelliSlot card may be installed during any state of UPS operation (On, Standby or Off states). Available Liebert IntelliSlot options are described below.

D. Liebert IntelliSlot Web Card (IS-WEBCARD)

E. The optional Liebert IntelliSlot Web Card shall deliver SNMP and Web management to the UPS when connected to any 10 or 100 Mbit Ethernet network. The card shall support 10 and 100 Mbit Ethernet and shall provide for in-the-field upgrade of SNMP firmware. The kit shall include the Liebert IntelliSlot card, MIB, configuration cable and user manual.

F. Liebert IntelliSlot Relay Interface Card (RELAYCARD-INT)

G. The optional Liebert IntelliSlot Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS. The contacts shall be rated for 24VAC or 24VDC at 1A. Connections shall be to a DB25F connector with cable provided by the end user.

2.4 ANY-MODE SHUTDOWN

A. The purpose of Any-Mode Shutdown shall be to shut down the UPS output by turning off the rectifier, inverter, and bypass so that there is no power to the loads.

B. Any-Mode Shutdown can be operated locally and remotely, as described as follows:

C. Local Any-Mode Shutdown can be performed by shorting Pin 1 and Pin 2

D. Remote Any-Mode Shutdown can be performed by a switch connected to Pin 1 and Pin 2 and mounted at a remote location.

E. Remote Power Off shall be performed either by NO or NC contact of Any-Mode Shutdown, depending on the settings in the configuration program.

F. A current-limited source (+12VDC, 50mA) shall be available from the UPS.

G. The connection to the UPS for remote connection shall be via terminal block connector.

H. Any-Mode Shutdown wiring shall conform to all national, regional, and local wiring regulations.

2.5 BATTERY MODE SHUTDOWN

A. Battery Mode Shutdown shall permit shutting down the UPS by turning Off the rectifier, inverter, and bypass so that there is no power to the load when the UPS is On Battery. Battery Mode Shutdown can be performed locally or remotely:

B. Local Any-Mode Shutdown can be performed by shorting Pin 3 and Pin 4.

C. Remote Any-Mode Shutdown can be achieved by a switch connected to Pin 3 and Pin 4 and mounted at a remote location.

D. On Battery

E. On Battery signal shall be a normally open (NO) dry contact. When the UPS is supplying output power from the battery this dry contact shall be closed.

F. Low Battery

G. Low Battery signal shall be a normally open (NO) dry contact. When the UPS is supplying output power from the battery and has reached the Low Battery Warning time selected in the configuration program, this dry contact shall be closed.

H. The rated values for the dry contacts shall be:

I. Rated Voltage: 5V

J. Working Voltage Range: 4.5-10V

K. Rated Current: 30Ma

2.6 LIEBERT REMOTE SYSTEMS MONITORING

A. All UPS systems must integrate into the existing UPS remove monitoring system to be approved for installation.

2.7 WARRANTIES

A. Minimum of 3 years of standard warranty with ability to extend by at least 2 additional years. Advanced replacement of defective equipment shall be offered as a standard service.

PART 3 - EXECUTION

3.1 GENERAL

A. Confirm the exact power output distribution requirements with the Owner's Representative.

B. Estimated runtime of 30 minutes is required. Provide Quantity (2) Two Optional External Battery Cabinets in base bid. Check with Owner’s Representative for additional requirements.

C. Secure approval of UPS locations with IT Facilities.

D. Input Disconnect

1. Install disconnect to input of UPS applicable to the size and type of appliance.

2. 10 KVA UPS installations shall have a wall mounted disconnect (EPO) within the IT Equipment room.

3. 6 KVA UPS installations shall have a wall mounted disconnect (EPO) within the IT Equipment room.

4. 3 KVA Disconnect or EPO is provided within the UPS itself.

E. Demonstration

1. Full functionality of UPS by:

a. Disconnecting power to the UPS and demonstrating ability of UPS to carry load consistent with the manufacturers' runtime for the attached load.

b. Demonstrate that the UPS passes the manufacturers diagnostic software with no errors.

END OF SECTION

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. The Section applies to all new TR rooms within the project. Work of this Section includes:

1. Indoor Copper Backbone Cabling between Telecommunications Rooms.

2. Indoor Copper Backbone Cabling between Telecommunications Rooms and MPOE.

3. Indoor Optical Fiber Backbone Cabling between Telecommunications Rooms.

1.2 SYSTEM DESCRIPTION

A. High-capacity infrastructure required to support aggregated voice and data communications to areas outside the immediate influence of the local TR Room.

B. Communications Back Bone typically consisting of:

1. Category 3 Voice Grade Copper Communications Infrastructure Backbone

2. Optical Fiber Transport Medium(s) Infrastructure Backbone

C. This section may describe configurations for cabling associate with the Owner Medical Center Campus. Offsite configuration may require circuit extensions and single entrances not described in the specification. Report conflicts between construction drawings and IT standard to the Owner representative before purchasing material or proceeding with installation.

1.3 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

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J. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

K. 27 13 43 COMMUNICATIONS SERVICES CABLING

L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, AND ANTENNA SYSTEMS

1.4 SUBMITTALS

A. Provide submittal information for the following submittal sections as described below:

1. Product Data

2. Shop Drawings:

a. Cable routing and Grouping Plan.

b. Front of Rack elevations showing completed as-built corrections.

c. Provide as-built records of equipment cabinet/rack with addressing and labeling scheme.

d. Provide as-built fiber strand, adapter panel, and FDU and WME housing addressing, and labeling scheme as installed.

PART 2 - PRODUCTS

2.1 CATEGORY 3 RISER / HORIZONTAL BACKBONE CABLING

A. Shall be EIA/TIA Category 3 cable

B. Each conductor shall be a minimum of 24 AWG

C. Plenum Rated (CMP) Solid conductor 100-ohm multipair UTP (Unshielded twisted pair), formed into 25 pair binder groups.

D. Imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2’.

E. The word "FEET" or the abbreviation "FT" shall appear after each length marking.

F. Provide Telecommunications plenum (CMP) rated cabling for horizontal and cables designated as riser cable.

G. Manufacturer:

1. General Cable

2. Or approved equal.

2.2 FIBER OPTIC COMMUNICATIONS CABLING

A. Fiber Optic Cable, Inside Distribution, Breakout Cable

1. Manufacturer: General Cable BEXXX1PNU-ILPA and APXXX1PNU-ILPA (where “XXX” equals strand count)

2. Or AFL .

B. Fiber Optic Cable, Plenum

1. General Cable BEXXX1PNU-ILPA and APXXX1PNU-ILPA, where XXX equals strand count.

2. Or AFL CRXXX9891#01-AIAR .

PART 3 - EXECUTION

3.1 GENERAL

A. All system cabling and terminations shall be installed in accordance with manufacturer's instructions and as indicated on Contractor’s submittal documentation, prior to final acceptance/approval by the Owner.

B. Installation shall be performed and accomplished in a professional manner, by qualified personnel.

3.2 PERFORMANCE STANDARDS

A. Telephone (Voice) Copper Cabling Plant

1. Suitable for direct connection to the public switched network in accordance with rules set forth by FCC Part 68, California Public Utilities Commission, and other authorities having jurisdiction.

2. Category 3 as defined in TIA-568-C.2

B. Fiber Optic Cabling

1. The optical loss budget for any end-to-end link not to exceed the sum of (optical fiber loss + splice loss + connector loss).

2. Optical fiber loss shall be the optical fiber specified cable performance, pro-rated for total link distance.

3. Fiber loss, multimode, not to exceed:

a. At 850 nanometers, 3.5 dB per kilometer; at 1300 nanometers, 1.5 dB per kilometer.

4. Fiber loss, single mode, outside plant cable, not to exceed:

a. At 1310 nanometers, 0.5 dB per kilometer; at 1550 nanometers, 0.5 dB per kilometer.

5. Fiber loss, single mode, inside plant cable, not to exceed:

a. At 1310 nanometers, 1.0 dB per kilometer; at 1550 nanometers, 1.0 dB per kilometer.

6. Splice loss, multimode not to exceed 0.15 dB for each fusion splice.

7. Splice loss, single mode not to exceed 0.06 dB for each fusion splice.

8. Connector loss, multimode not to exceed 0.75 dB for each mated pair of type lc, ultra polish connector.

9. Connector loss, single mode not to exceed 0.60 dB for each mated pair of type lc, ultra polish connector or 0.30 dB for each mated pair of type lc, angle polished connector.

3.3 INSTALLATION

A. CAT3 COPPER BACKBONE CABLE

1. Application for TR / MPOE / EF CAT3 Interconnectivity Copper Backbone.

2. Minimum configuration of CAT3 Interconnectivity between MPOE and all telecommunications TR rooms shall be a 50 Pair, to each TR.

B. FIBER OPTIC CABLING

1. Minimum Interconnectivity between MPOE and all TR’s shall be 24 strand SM fiber, to each TR.

2. Interconnectivity from the secondary EF to all other TR’s shall be 24 strand SM fiber, to each TR.

3. Diverse physical pathway shall be determined between telecommunications rooms that precludes using a single physical pathway for all backbone cabling between TR’s.

4. At TR / MPOE and EFs, at both ends of cables, wrap the room before entering patch panel by a dressed route.

5. At interior: Provide splice free cabling between telecom rooms; as well as between telecom rooms and all locations in the same building indicated for fiber cabling media.

6. Terminate fibers using a pre-terminated LC connector where indicated by Owner Representative.

7. Review proposed breakout procedure with the Owner’s Representative before beginning this work.

8. Refer to OWNER IT elevations and distribution drawings for further details.

3.4 TESTING

A. GENERAL

1. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications room wiring.

2. Test each end-to-end cable link.

3. Submit machine-generated documentation and raw data of all test results on Contractor-provided, and Owner’s representative approved, forms; and in electronic format approved by the Owner’s Representative.

3.5 TEST PROCEDURES – COPPER

1. A new cable shall be tested only after all wires within the cable have been terminated at both ends.

2. The Contractor shall test all high-count copper cables and submit test result information in an electronic format. Acceptable formats are Word, Excel. Owner's representative to provide required format for test report documentation.

3. TEST #1 – Continuity: Use multi-meter capable of reading resistance.

4. Meter set for 20-ohm full scale ohm reading. Each pair shall be shorted at one end and the loop resistance value read at the other.

5. The difference between the largest and the smallest resistance reading from each pair in the cable shall be no more than 10 percent of the largest reading.

6. TEST #2 - Balance, Polarity and Conductor Transpositions:

7. Upon passing Test #1, the tester at one end of cable shall ground tip side of each pair in turn. The tester at other end of cable reads resistance to building ground of same conductor.

8. REQUIREMENT: Reading for each tip conductor in pair of approximately one-half the loop resistance value from Test #1.

9. The Contractor shall correct all defects possible.

10. If the maximum number of unrepairable defective pairs exceeds 1% of the cable's pair count, the cable shall be deemed unacceptable and shall be replaced. Replace, re-terminate and retest new cable at no additional cost to the Owner.

11. Comply with the detailed reporting results described above and the following: high pair count copper cables.

12. Submit Test Report. Documentation shall include loop resistance regarding any opens, shorts, transpositions found, as well as corrective action taken to correct any found opens, shorts, or transpositions.

3.6 TEST PROCEDURES – FIBER

A. Testing

1. The Contractor shall test all fiber optic cables and submit all fiber test result data in electronic format.

2. Perform fiber optic cable testing on all installed fiber optic cabling. Submit test results. Notify Owner’s representative in writing at least 72 hours in advance that fiber optic cable testing shall commence. Submit calibration certification for testing equipment to be used.

3. A new cable shall be tested only after all wires within the cable have been terminated at both ends unless specifically requested by the Owner.

4. Fibers tests shall include OTDR, results with the meter set to the wavelength measurements specific to the cable or as requested by IT.

5. A second set of testing shall be power meter for the same strands

6. OTDR Distance and Attenuation Assessments perform on all cabling segments perform in accordance with the requirements of: TIA-568-C.1, TIA-568-C.3, TIA-455-59-A.

7. Test all fibers with launch and far end cable of sufficient length for the OTDR to be able transmit through all installed connectors.

8. OTDR through all connectors, a one-way test is not acceptable. Means and methods to fully evaluate product installed shall be approved prior to commencing.

9. Test and submit strip charts and/or tracer recordings on all strands in each tube in every cable in both directions.

10. User Interface records including a graph depicting fiber loss locations and total DB loss per event via OTDR.

11. Submit test report no later than five days after the cables are tested.

B. Test and submit OTDR attenuation assessments test results on each fiber, in each cable, and in both directions under final installation conditions. Submit with the following information:

1. Date of test

2. Name of test personnel

3. Test wavelength

4. Pulse duration(s) and scale range(s)

5. Index of refraction

6. Fiber cable type and part number

7. Fiber tube and/or fiber strand number

8. Direction of test

9. Overall distance

10. Attenuation in dB

11. Localized attenuation shall not exceed 0.5 dB at any point

3.7 TEST EQUIPMENT

A. Contractor shall provide all test equipment as required to perform the scope of work.

B. Test the communication systems cabling using at least one (1) each of the following test measurement devices or their functional equivalents:

1. Level III field testers as defined in TIA-1152 – Fluke DSX-5000, or equal.

2. The tester including the appropriate interface adapter must meet the specified accuracy requirements.

3. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of TIA-1152.

4. The RJ45 test plug shall fall within the values specified in TIA-568-C Annex C for NEXT, FEXT and Return Loss.

5. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.

6. In order to deliver optimum accuracy, permanent link interface adapter for the tester shall be used, which can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor.

7. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

8. Outside Plant Voice Cabling Plant tester - capable of detecting shorts, opens, reversals, mis-wiring and cross twists.

a. Siemon STM-8, Fluke or equal.

C. Optical Power Meter - Multimode

1. Corning Cable Systems, Fluke or equal

2. Minimum Performance - Multimode Power Meter 850nm and 1300nm +/- 20 nm wavelength LED light sources.

3. Spectral width of sources shall be </= 50nm for 850nm wavelengths and </= 140nm for 1300nm wavelengths.

4. Output Stability +/- 0.40 dB from 0 to 50 degrees C

5. Long Term output stability +/- 0.10dB at 25 degrees C Connector types to include: LC only.

D. Optical Power Meter – Single Mode

1. Corning Cable Systems, Fluke or equal

2. Minimum Performance - Single Mode Power Meter 1300nm and 1500nm +/- 20 nm wavelength laser light sources.

3. Output Stability +/- 0.40 dB from 0 to 50 degrees C

4. Long Term output stability +/- 0.10dB at 25 degrees C Measurement range shall be from 10 to -60 dBm

5. Accuracy shall be +/- 5% at 0 to -50dBm and +/- 10% 10 to 0dBm and -50 to-60 dBm.

6. Resolution shall be 0.1 dB

7. Connector types shall include LC only.

8. Optical Time Domain Reflectometer. (Fluke, JDSU or equal).

3.8 EXAMINATION & ACCEPTANCE

A. Testing Results Review and Verification by the Owner

1. Contractor shall submit (1) copy of software capable of viewing the electronic test result files.

2. Data found to be altered from the manufacturers recommended settings may result in retention by the Owner of a 3rd party test company to retest the installed cabling at the expense of the Contractor.

3. Events exceeding industry standards will cause the test result to be rejected. Direct review by

4. Owner IT will be required to allow for an exception of a test result.

5. Data found to be incomplete may result in retention by the Owner of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.

3.9 FINAL REVIEW

1. Walk each route defined in preparation section and describe the diverse and redundant routes taken for each and all backbone cables.

2. Produce documentation and illustrate during walk thru the labeling completed.

3. Provide UL listings and display conformance to all Fire ratings and UL listings between all locations. Provide signed inspections reports depicting authority having jurisdiction approval of all work completed.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Provisioning, installation, termination, and testing of twisted pair, horizontal cabling in modular furniture and hard wall workstations located throughout the project area. Work under this section will include:

1. Wireless Access Point cabling

2. Printer Stations

3. IP Camera Cabling

4. Monitor and CATV cabling

5. IP Medical Equipment in Exam Rooms

6. All workstation cabling as defined on the construction documents

1.2 TYPICAL WORK AREA OUTLETS

A. A typical work area outlet (per chair) or (Drop) shall consist of two (2) (Purple end to end) Category 6A Data cables, unless otherwise indicated.

1. When re-cabling a building or office consideration shall be made to add Data Cables to support devices that will continue to be viable after a transition to a VoIP network such as fax machines, fire alarms, elevator phones, pay phones etc.

B. A typical work area outlet shall have a slack loop of 10 feet at the field end of the run.

1.3 OTHER OUTLET CONFIGURATIONS

A. Wireless Access Points

1. A typical wireless access point (WAP) Outlet shall consist of two (2) (Purple end to end) Category 6A Data cables, unless otherwise indicated.

B. Timeclock Outlet

1. A typical time cock outlet shall consist of one (1) (Purple end to end) Category 6A Data cable, unless otherwise indicated.

C. Other outlet configurations as defined by and coordinated with Owner IT.

D. All Outlet types listed above shall have a slack loop of 10 feet at the field end of the run.

1.4 RELATED SECTIONS

A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

I. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

J. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

K. 27 13 00 COMMUNICATIONS BACKBONE CABLING

L. 27 13 43 COMMUNICATIONS SERVICES CABLING

M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS

N. 27 51 16 PUBLIC ADDRESS SYSTEMS

O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

Q. 27 53 13 CLOCK SYSTEMS

R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

PART 2 - PRODUCTS

2.1 MODULAR JACK COMPONENTS, GENERAL

A. Modular Jacks rated Category 6A

1. Panduit Mini-Com CJ6X88TGVL.

2. Colored Icons as needed per UCDM service designation.

3. Panduit PAN_CID(XX).

2.2 COPPER CABLING, CATEGORY 6A

A. High Speed, TIA category 6A Cabling, Plenum Rated

1. General Cable GenSpeed 6A Part No.7141877 Purple

2. General Cable GenSpeed 6A Part No. 7151855 Purple

a. Use of the improved Genspeed cable is dependent on availability. Do not default to this cable if lead times are excessive.

2.3 TELECOMMUNICATIONS OUTLET COMPONENTS

A. Modular Furniture Surface Mount Box, Black

1. Panduit CBXQxBL-A Where x = number of ports

2. Modular Surface Mount Box Attachment System Mini-Com CBM-X

3. Modular Surface Mount Box Blank Insert Panduit CMB(BL)

B. Faceplate

1. Panduit- Mini-Com Faceplates (CFP (2,4,6)SY I CFP (4,8,10) S-2GY

2. Coordinate finish with Architect prior to submittals

C. Faceplate Blank Insert

1. Panduit CMB(WH)

D. Stainless Wall Telephone Outlet

1. Leviton 40223-S (where specified)

E. One Hole Wall Plate

1. Leviton 84004-40 Stainless where requested.

2. Leviton 80720-W White where requested.

3. Coordinate finish with Architect prior to submittals.

F. Black Loom

1. Panduit loom CLT100F/CLT150F (choose size appropriate for cable installation quantity)

2. Thomas & Betts black liquid tight EFC150

G. Duplex In-Line Jack frame, one to four jacks (only where required, NOT standard installation)

1. Panduit Mini-Com 106 Duplex Module Frame

PART 3 - EXECUTION

3.1 CABLING RUN LENGTHS

A. Distance limitation of the in-wall cabling shall be thoroughly reviewed and calculated to be less than 275' when including the anticipated plug pack cabling length in the telecommunications room (TR).

B. Contractor to field verify the performance including cable length of the proposed installation in a mockup using the proposed cabling, jacks, raceway and test equipment prior to proceeding.

1. Locate proposed cable pathway drawing for the upcoming cable run.

2. Contractor to install One (1) typical copper work area outlet complete with jacks at both ends.

3. Use the proposed pathway and cabling to the furthest location from the TR.

4. Install a cable simulating the cable length of the Plug Pack configuration.

5. The cabling contractor is to perform testing of these cables patched together to determine the true length of this mockup.

6. Test Results are to be inspected and reviewed by the University's Representative prior to proceeding with the rest of the installation.

7. Any deficiencies in the installation of the mockup are to be corrected by the Contractor and re-inspected by the University's Representative prior to proceeding with the rest of the installation.

3.2 MODULAR JACK COMPONENTS

A. Category 6A Data Jacks performance shall meet requirements as defined in TIA standards.

B. Follow manufacture's Installation procedures.

3.3 TELECOMMUNICATIONS OUTLET EXECUTION

A. Modular Furniture Surface Mount Box, One to Four Jacks

1. Surface mount box magnetically attached to furniture.

2. Removing knockouts in the base of the furniture shall be avoided.

B. Telecommunications Outlets. New, Copper Jacks, Wall Mount, Flush Mount Assembly.

1. Complete outlet assembly, including but not limited to:

2. Faceplate with manufacturer's standard jack openings

3. Blank connector modules at faceplate openings not filled with connector modules.

4. Features: Single gang with openings for the required number of cables. Provide flat stainless steel.

5. Features: Double gang with openings for the required number of cables. Provide flat stainless steel.

C. Voice Telephone Station Plates and Jacks (special provision)

1. Wall Mounted Analog Telephone

2. Wall mounted IP Telephone Station

3. Single outlet wall plate w8P8C data Jack

3.4 COPPER CABLING DATA VOICE/DISTRIBUTION

A. Maintain the following clearances from EMI sources (Per BICSI Standards)

1. Power cable – 6 in.

2. Fluorescent Lights - 12 in.

3. Transformers- 48 in.

B. Monitor cable length limitations.

1. All cable installations shall be continuous, un-spliced runs

2. All wiring above ceilings shall be installed in cable tray or cable hangers.

3. Cable in accessible ceilings shall be supported 5' on center (min) attached to building structure.

4. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket.

5. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.

6. Limit cable bends to a minimum radius of 4 times cable diameter except where otherwise noted herein.

7. Refrain from exceeding fill ratio on horizontal cabling installations

8. Do not put large sweeps or service loops in vertical wire managers.

9. Provide slack, which is to be no less than 2.5" and no greater than 5.0", in the station cable at the station outlet end. The Work Area Outlet shall provide enough slack to be serviceable without excess.

10. Service loop at outlet locations: Provide a (10') Ten Foot Slack Loop for all horizontal cabling, supported on J-hook with wire above all drop locations.

11. All data and voice station cable shall be terminated at the individual receptacle modules in accordance with ANSI/TIA-568-C, assignment T568B.

3.5 TESTING

A. All system cabling and terminations shall be installed in accordance with manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.

B. Installation shall be performed and accomplished in a professional manner, by qualified personnel.

3.6 PERFORMANCE STANDARDS

A. Horizontal (Station) category 6A Copper cabling - Permanent Link

1. Testing shall commence while the University's equipment in the area of service is operational and creating worst case emissions associated with its operation while in good working order. Every effort shall be made to include worst case influence on the materials installed shall be taken.

2. In accordance with the field test specifications defined in TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard", every horizontal station cabling link in the project shall be tested for:

a. Wire Map Length Insertion Loss NEXT Loss

b. PS NEXT Loss

c. ACR-F Loss

d. PS ACR-F Loss

e. Return Loss

f. Propagation Delay

g. Delay Skew

B. Using the listed category 6A cable test set, test installed cabling using Permanent Link procedure and submit report demonstrating that the link meets the following:

1. Each permanent link shall demonstrate a positive PSACR beyond 350 MHz to meet and exceed the bandwidth requirements of TIA-568-C.2 Category 6A standards.
2. Each permanent link shall demonstrate 2 dB of cross talk headroom over TIA -568-C.2 Category 6A standard for NEXT, PSNEXT, ELFEXT and PSELFEXT bit error rate.
3. Report whether tested link passes or fails.
4. Note exceptions to required Category standards. Remedy and retest.
5. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications room wiring.
6. Test each end-to-end cable link
7. Submit machine-generated documentation and raw data of all test results on Contractor-provided, and University's Representative approved, forms; and in electronic format approved by the University's Representative.
8. Test stations wire only after all pairs of station wire in a work area have been terminated at both ends, and no work of this Section or other Sections may cause physical disturbance to the wiring.
9. Correct any and all transpositions found. Retest.
10. If any conductor in a station wire tests either open or short, then the entire station wire is to be removed, replaced, and re-tested.
11. The Contractor shall test all cables and submit all horizontal copper cable test result data in electronic format, with the resulting file formatted with one test result per 8.5"x 11" page. Export or Download the test results from the cable tester to a •.txt format or other accepted proprietary format for submission.
12. Data found to be altered from the manufacturers recommended settings may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
13. Events exceeding industry standards will cause the test result to be rejected. Direct review by UCD IT will be required to allow for an exception of a test result.
14. Data found to be incomplete may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
15. Contractor shall submit (1) copy of software capable of viewing the electronic test result files. Testing Results shall be reviewed and verified by the University before payments are remitted.

C. Test Equipment

1. Contractor shall provide all test equipment as required to perform the scope of work.
2. Test the communication systems cabling using at least one (1) each of the following test measurement devices or their functional equivalents:
    a. Level III field testers as defined in TIA-1152 - Fluke DSX-5000, or equal.
    b. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of TIA-1152
    c. The RJ45 test plug shall fall within the values specified in TIA-568-C Annex C for NEXT, FEXT and Return Loss.

d. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.

e. In order to deliver optimum accuracy, permanent link interface adapter for the tester shall be used, which can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface.

f. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor.

g. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

h. Site portable communications systems (walkie-talkie, cell phone, or similar to aid in communications between test device locations)

END OF SECTION

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