

SPECIFICATIONS

FOR

PROJECT NO. 9558910

Davis Tower #0711 & 0762 Pharmacy Remodel

HCAI NO.: S241013-34-00

**FACILITIES PLANNING AND DEVELOPMENT DIVISION
UC DAVIS HEALTH**

**SACRAMENTO, SACRAMENTO COUNTY
CALIFORNIA**

June 14th, 2024

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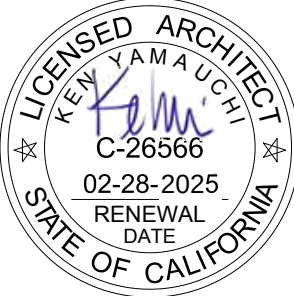
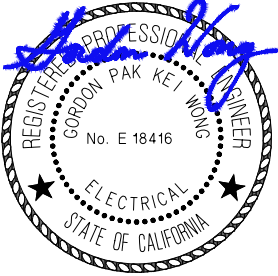
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 Architectural	 Mechanical & Plumbing
 Electrical	 Security

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[End]

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: DAVIS TOWER #0711 & 0762 PHARMACY REMODEL
- B. University Project No.: 9558910
- C. Project is located at 2315 X Street, Sacramento, CA 95817, UC Davis Health, Sacramento, California, as shown on the vicinity map.
- D. Project is the renovation of the Pharmacy Department at the basement level approximately 470,996SF, including the addition of new support spaces. Work will be carried out in sequences to ensure uninterrupted pharmacy operations, with temporary equipment relocation utilizing existing storage #0761. The scope also includes the remodel of multi-user toilet rooms #0786 and #0784 to address accessibility deficiencies and ensure compliance with current code. Project consists of the demolition of existing spaces within the basement pharmacy (except for Central Pharmacy #0762) and a remodel that includes the receiving area, non-sterile compounding room, hazardous drug storage room, staff

lounge, and offices. The scope does not include sterile compounding rooms (under USP797/800).

- E. A description of areas, types of construction and general nature of the Work are described on drawing (A0.1) and on the TIO (Section 01 45 50). See also Section 01 14 00.

PHASE 1: Remodel of Non-Sterile Compounding Room (0711A) and Staff Lounge (0779)

PHASE 2: Remodel of Narc Pharmacy (0762H), Multi-User Women's Restroom (0786) and Multi-User Men's Restroom (0784)

PHASE 3: Remodel of Office Spaces (0711C & 0715A), Hallway (0715), building of Office (0715B), Receiving Area (0776) and HD Drug Storage (0778)

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

1.03 CONTRACTOR WARRANTIES

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

1.04 CONTRACT DOCUMENT INTENT AND RELATIONSHIPS

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

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

subcontractors or in establishing the extent of the work to be performed by any trade.

2. Specifications are included in the Contract, which also includes other Bidding and Contract Documents. Contents of the Contract are listed in the TABLE OF CONTENTS.
3. Information for bidding, Conditions of the Contract and other Contract documents will be produced by University. Such documents are not Specifications. Specifications are found in Division 1 through 48 of the Contract.

1.05 UNIVERSITY-FURNISHED, CONTRACTOR-INSTALLED (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. C2 Vault
2. Hood, Horizontal Laminar Flow
3. Sink, Scrub, 1-Bay, Stainless Steel
4. Carousel
5. Cabinet, Bio Safety, Class II, Type A2, Floor
6. Dishwasher, Commerical
7. Dispenser, Hand Sanitizer, Wall Mount
8. Dispenser, Shoe Cover / Bouffant Capautomatic
9. Dispenser, Soap, Wall Mount
10. Freezer, Laboratory, 1 Door; R600A Group A3 Refrigerant, 0.2875 LB Refrigerant Charge
11. Dispenser, Medication, Auxiliary
12. Mirror, Vanity
13. Printer, Multi-Function
14. Refrigerator, Pharmaceutical, 1 Door; R600A Group A3 Refrigerant, 0.209 LB Refrigerant Charge
15. Refrigerator, Cubixx, Existing; R29 Group A3 Refrigerant, 0.2625 LB Refrigerant Charge
16. Refrigerant, Pharmaceutical, 2 Door; R600A Group A3 Refrigerant, 0.2425 LB Refrigerant Charge
17. Cart, Supply, Stainless, 48 Inch

18. Water Treatment System, Pharmacy Dispensing
19. Toilet Paper
20. Paper Towels

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

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

A. University-Furnished Products: University will furnish and install products which may be identified on the Drawing and in the Specifications as UFUI (University-Furnished/University-Installed).

1. Balance, Lab, Precision
2. Bench, Gowning
3. Cart, Supply, Enclosed, Kit Check
4. Conveyor, Portable, Acordian
5. Cart, Supply, Stainless, 72 Inch
6. Cart / Truck, Soiled Utility
7. Disposal, Sharps, Floor Bin, Pharmacy
8. Cart, Procedure, General
9. Cart, Supply, Stainless, 24 Inch
10. Cart, Supply, Stainless, 36 Inch
11. Cart, Supply, Stainless, 48 Inch

B. Relationship to Work Under the Contract: Work under the Contract shall include all provisions necessary to provide all rough-in requirements into the Work, including as necessary but not limited to fasteners, backing, supports, piping, conduit, conductors and other such provisions from point of service to point of connection, and field finishing, as

shown on the Drawings and/or specified herein. See Section 013100 - COORDINATION for additional requirements.

1.07 CONCURRENT WORK UNDER SEPARATE CONTRACTS

- A. Work Under Separate Contracts: University will award separate contracts for the following work and other work as may be indicated on the Drawings as NIC (Not in Contract), including the following, with coordination by the bidding contractor:
1. MESA 3 – Precautionary Airflow Readings, Pre-Balance and Balance inside and outside the area of work as indicated on the Mechanical Air Precautions Plans.
 2. TBD - Third Party Commissioning Services
 3. Entek - EH&S 3rd Party ICRA Compliance Verification
 4. Precept - Sampling - Domestic Water Sampling
 5. UCDH IT – Potential install of desktop equipment during the construction period.
 6. TBD – 3rd Party Special Inspection

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

1.08 SITE CONDITION SURVEY & PROTECTION OF EXISTING IMPROVEMENTS

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

1.09 CONTRACTOR USE OF SITE AND PREMISES

- A. Site Access: Limit access to site as indicated on the drawings. If routes and access points are not indicated, access shall be as directed or approved by University's Representative.
- B. Hours of Operation: Construction activities are limited to the hours of 7:00 a.m. to 5:00 p.m., Monday through Friday. Prior University approval is required for Contractor construction work at any other time or day.
- C. Construction Limit: Limit construction activities to areas indicated on Drawings as Project Area or, if not indicated, to areas immediately adjacent to buildings and as necessary for immediate construction or utility services and sitework, See Section 015100 - TEMPORARY UTILITIES for additional requirements.
- D. Utility Outages and Shutdowns: Schedule utility outages and shutdowns to times and dates acceptable to University's Representative. Duration of outages and shutdowns shall

not hinder University normal business operations. Provide fourteen (14) calendar days' notice of all utility outages and shutdowns.

1.10 UNIVERSITY BENEFICIAL OCCUPANCY

A. See SECTION 01 14 00

1.11 PROJECT PHASING

See SECTION 01 14 00

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not applicable to this Section

END OF SECTION 01 11 00

SECTION 01 14 00

WORK RESTRICTIONS

PART I - GENERAL

1.01 WORK HOURS

- A. No Work shall be done outside of standard Monday through Friday 7:00 a.m. to 5:00 p.m. working hours, on holidays or weekends unless prior written approval has been retained from the University's Representative.

1.02 PROJECT PHASING

- A. The work of this contract is divided into three (3) Phases. Note, Phase 1 must be completed prior to the start of Phase 2. The start of Phase 3 will not be dependent on substantial completion of phase 2.
 - 1. Total Contract Time is 891 Calendar Days from NTP. Within this total contract time are the following Phases.
 - a. PHASE 1 – Remodel of Non-Sterile Compounding Room (0711A) and Staff Lounge (0779), see proposed work sequence in below section 1.03.A.1. Phase 1 shall be substantially complete within 296 Calendar Days from NTP. Within the total contract time allow 14 calendar days after substantial completion for staff and stock, licensing, and personnel moves.
 - b. PHASE 2 (147 Calendar Days): Remodel of Narc Pharmacy (0762H), Multi-User Women's Restroom (0786) and Multi-User Men's Restroom (0784), see proposed work sequence in below section 1.03.A.2. Phase 2 shall be substantially complete within 457 Calendar Days from NTP.
 - c. PHASE 3 (455 Calendar Days): Remodel of Office Spaces (0711C & 0715A), Hallway (0715), building of Office (0715B), Receiving Area (0776) and HD Drug Storage (0778), see proposed work sequence in below section 1.03.A.3. Phase 3 shall be substantially complete within 891 Calendar Days from NTP. Within the total contract time allow 28 calendar days between completion of Hazardous Drug Holding and the start of 0711C Refresh for staff and stock, licensing, and personnel moves.

1.03 WORK SEQUENCE and WORK RESTRICTIONS

A. Preliminary Work Sequence Outline

1. PHASE 1

- a. Mobilization and Procurement (Construction)
- b. Move out of Office 0711C (UCDH)
- c. Non-Sterile Compounding Space 0711A (Construction)
- d. Move Kit Check to 0711C (UCDH)
- e. Make Ready Door Install in Narc Vault (Construction)
- f. Staff Lounge 0779 (Construction)
- g. Relocate Repackaging Equipment to 0761 (UCDH)
- h. Pedi Pod Move to Non-Sterile Compounding (UCDH)

2. PHASE 2

- a. Pedi-Pod Demo (Construction)
- b. General Pharmacy Finishes and Furniture Install (Construction)
- c. Restroom ADA Work (Construction)
- d. Carousel Install (Construction)

3. PHASE 3

- a. Exhaust Fan Install and Start-up (Construction)
- b. Relocate Receiving Function (UCDH)
- c. Kit Check / Receiving Area (Construction)
- d. Relocate Pyxis (Construction)
- e. Office 0715A (Construction)
- f. Hazardous Drug Holding (Construction)
- g. Phase 3 Move (UCDH)
- h. 0711C Refresh (Construction)
- i. Substantial Completion (Construction)

B. Work Restrictions

1. Existing areas, functions, and utilities outside of the area under construction are to remain operational, open and unobstructed.
2. This project is located in an existing occupied building, 24/7 fire watch will be required during shut down of existing fire sprinkler or fire alarm systems.

1.04 CONTRACTOR'S USE OF PROJECT SITE

- A. Contractor's use of the Project site for the Work and storage is restricted to the areas designated on the Drawings.

1.05 UNIVERSITY OCCUPANCY

- A. Kit Check / Receiving Area needs to complete prior to University move out of 0711C which is a constraint for work to begin for 0711C refresh.
- B. Throughout the project the surrounding areas will be occupied during construction. Reference the bid documents to understand areas that will require early occupancy to ensure uninterrupted pharmacy operations throughout construction.

1.06 SUBSTANTIAL COMPLETION

- A. See phasing for Substantial Completion.

1.07 PROTECTION OF PERSONNEL

- A. Patients, University of California Davis (UCD) personnel and Students, will be occupying parts of the adjacent buildings during the construction period. Contractor shall take proper precautions to ensure the safety of all persons during the construction period.

1.08 WORK SITE DECORUM

- A. Extreme care to limit noise shall be taken at all times that the building is occupied. Loud or unnecessary conversation shall be avoided. The playing of radios, or any audio devices shall be strictly prohibited. Noise, that in the sole opinion of the University's Representative, is disturbing or disruptive to occupants of the building shall be scheduled for periods when the building is not occupied.
- B. Contractor shall control the conduct of its employees so as to prevent unwanted interaction initiated by Contractor's employees with UCD staff, patients, students or other individuals, adjacent to the Project site. Without limitation, unwanted interaction by Contractor's employees includes whistling at or initiating conversations with passersby. In the event that any Contractor's employee initiates such unwanted interaction, or utilizes profanity, Contractor shall, either upon request of University's Representative or on its own initiative, replace said employee with another of equivalent technical skill, at no additional cost to the University.

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

1.09 INTERRUPTION OF BUILDING SERVICES

- A. Planned utility service shutdowns shall be accomplished during periods of minimum usage. In some cases, this will require Work activities before 8:00 a.m. and after 5:00 p.m. and weekend Work, at no additional cost to the University. At least 14 calendar days advance notice shall be given to the University's Representative before interruptions to utility service (refer to Utility Service Interruption/Shut Down Request) and other interferences with use of existing buildings, surrounding hardscape and roads.
- B. Shutdowns critical to the completion of the project shall be listed as Milestones on the project schedule. The Contractor shall program work so that service will be restored in the minimum possible time and shall cooperate with the University in reducing shutdowns of utility systems.
- C. The University reserves the right to deny shutdown requests based on scheduled workload, research projects, and usage of surrounding buildings or other activities planned on campus.
- D. University's costs for initial planned utility service shutdowns shall be borne by the University. If repeat utility service shutdowns are required due to work necessary to correct Contractor's defective work, mistakes in new work layout such as misalignment or installation conflicts with other new work, University's costs for repeat shutdown(s) will be deducted from Contract Sum.

1.10 SITE INGRESS AND EGRESS

- A. Access to Project site shall be as indicated on the Drawings. Access to Project site is limited to designated routing on existing access roads. The Contractor and their employees, subcontractors, suppliers or delivery personal must stay on the designated roads and may not drive, ride or walk to other locations unless prior permission is provided in writing by the University's Representative.
- B. Contractor shall take all necessary precaution to ensure the safety of the bicyclists and pedestrians that use the campus roads.

- C. Contractor shall clean the site access and roads affected by the Work and shall maintain such in a dust free and safe and usable condition for motorists, bicyclists and pedestrians. During inclement weather Contractor shall closely monitor conditions to prevent slickness of roads.
- D. Contractor shall be permitted to block only 1/2 of a street at a time for momentary site access, unless specified otherwise. The street shall be operational and usable by the University at all times.

1.11 MOTOR VEHICLE AND BICYCLE TRAFFIC CONTROL

- A. Contractor shall adopt all practical means to minimize interference to traffic. Access to other facilities in the area shall be maintained at all times. The Contractor shall provide a schedule of any activity that will impact traffic, or any planned lane or street closure, for approval by the University's Representative and shall give a minimum of 14 business days notice before closing any street or access.
- B. Contractor shall furnish at its expense all signage barricades, lights, and flaggers required to control traffic and shall provide and maintain suitable temporary barricades, fences, directional signs, or other structures as required for the protection of the public; and maintain, from the beginning of twilight through the whole of every night on or near the obstructions, sufficient lights and barricades to protect the public and Work.
- C. Contractor shall provide directional signs for use throughout the duration of the Project. The quantity shall be determined by the University's Representative and Contractor during a mandatory Pre-construction site meeting. Contractor shall prepare a mock-up of the sign for approval by the University's Representative.
- D. It is the responsibility of the Contractor performing Work on, or adjacent to, a roadway or highway to install and maintain such devices which are necessary to provide reasonably safe passage for the traveling public, including pedestrians and bicyclists, through the Work, as well as for the safeguard of workers. Before Work begins, a site meeting shall be held to discuss motor vehicle and bicycle traffic control plans for handling traffic through a construction or maintenance zone. Traffic control plans shall be submitted for review by the University's Representative and public agency or authority having jurisdiction over the roadway or highway. These traffic control plans shall be prepared by persons knowledgeable about the fundamental principals of temporary traffic 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 through the RFI tool on the University Representative's Procore page for this project, or through 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. Submit RFIs through Procore or Email to the University's Representative. Procore and Email RFI requests received after normal business hours and/or received on non-normal workdays, as defined in Specification Section 013100–COORDINATION, Item 1.07.F.4.A will begin notification time starting at 7:00 a.m. the following workday.
- B. Failure to provide proper information: RFIs will not be recognized or accepted if, in the opinion of University's Representative, one of the following conditions exist:
1. Contractor submits the RFI as a request for substitution.
 2. Contractor submits the RFI as a Submittal.
 3. Contractor submits the RFI as a Contract Document discrepancy or omission without through review of the Documents (Capricious submission).
 4. Contractor submits the RFI assuming portions of the Contract Documents are excluded or by taking an isolated portion of the Contract Document in part rather than in whole.
 5. Contractor submits the RFI in an untimely manner without proper coordination and scheduling of Work of other Trades.
- C. Response Time: Request clarifications or information immediately upon discovery of need. Submit RFI's in a timely manner allowing full response time to avoid impacting Contract Schedule.
1. University's Representative, whose decision will be final, shall resolve issues and respond to questions of Contractor, in most cases, within fourteen (14) calendar days. Actual time may be lengthened for complex issues, or shortened for expedited situations, as mutually agreed in writing.

2. After submission of an RFI by Contractor and prior to receipt of the RFI response from University, the Contractor proceeds with effected Work at own risk. Any portion of the Work not constructed in accordance with University's interpretation, clarification, instruction or decision is subject to removal and replacement at Contractor's expense.
 - D. Failure to Agree: In the event of failure to agree to the scope of the Contract requirements, Contractor shall follow procedures set forth in Article 4 of the General Conditions of the Contract.
- 3.02 Refer to the following Attachment
- A. Request for Information

END OF SECTION 01 25 00

PROJECT NO. #####
PROJECT TITLE
PROJECT SUBTITLE

REQUEST FOR INFORMATION

Project #: _____ Project Title: _____
RFI #: _____ Date: _____ HCAI #: _____

UC Davis Health Facilities Design & Construction 4800 2 nd Avenue, Suite 3010, Sacramento, CA 95817 Attn.: Project Manager P: 916-734-#### C: ### ### ### Email: #####@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 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.

PROJECT NO. #####

PROJECT TITLE

PROJECT SUBTITLE

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.

PROJECT NO. #####

PROJECT TITLE

PROJECT SUBTITLE

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.

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. Coordinate percentage complete with Progress Schedule.
 - d. 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.
 - e. 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.

PROJECT NO. #####

PROJECT TITLE

PROJECT SUBTITLE

- f. The Sum of values listed shall equal total Contract Sum.
 - g. When University's Representative requires substantiating information, submit data justifying line-item amounts in question.
 - h. Provide one (1) PDF electronic file of data with cover letter for each copy of Application. Show Application number and date, and line item by number and description.
4. Submit Applications for Payment, Continuation Sheets and Schedule of Values under PDF electronic transmittal letter. Contractor shall identify all payment application documents by University's Project Name and University's Project Number.

1.07 SUBSTANTIATING DATA

- A. University's Representative may request substantiating information. Submit data reconciling line-item amounts in question.
- B. Provide one (1) PDF electronic file of data with cover letter for each copy of submittal. Show Application number including date and line item by number with description.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 29 00

SECTION 01 31 00

COORDINATION

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 (UFCL 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. The project is broken into three phases to ensure pharmacy operations remain uninterrupted, refer to the preliminary construction schedule for sequence and duration of owner activities throughout the phases. Contractor shall include these activities on the detailed project schedule and calculation of total Base Construction time. During construction Contractor shall notify University's Representative in writing a minimum of fourteen (14) calendar days prior to start dates of these activities.
- B. Equipment Coordination: Contractor and University supplied equipment will require complete installation data be exchanged directly between Contractor and vendors and subcontractors involved as progress of Project requires. Individual requesting information shall advise when it is required. Incorrect, incomplete, delayed or improperly identified equipment causing delay or error in installation will require entity causing such action to be liable for modifications or replacements necessary to provide correct and proper installation, including relocations.
- C. Contractor shall provide large scale casework and equipment drawings for casework and equipment service rough-in locations (dimensioned from building features), service characteristics, and locations of studs or blocking where such locations are critical to mounting or otherwise installing equipment and casework. Furnish sizes and spacing required for mechanical and electrical cutouts, and a complete brochure of fittings, sinks, outlets, or other information to provide a complete assemblage of the items and accessories being furnished.
- D. Interruption of Services: Construction Work shall accommodate University's use of surrounding and adjacent premises during the construction period and shall provide continuous public access and use of surrounding and adjacent facilities. Contractor shall not deny access to public use facilities until an alternate means of public use has been provided. An interruption of service is defined as any event which in any way interrupts, disrupts or otherwise discontinues, even momentarily, the services provided by University to its patients and staff. Adequate notice, as described below, shall be given to University when any interruption of services or interference with the use of existing buildings and roads are anticipated. Any interruption of service will be made only by University upon such notice. Interruptions to University services will not be made without prior notification and approval by University. Contractor shall never interrupt any University service without direct University participation.
 - 1. Dig Notification: Contractor shall complete and submit for review to University's Representative, a Dig Notification Form, included at the end of this section, and obtain written authorization from University prior to the commencement of any digging activities. Digging activities include exploratory demolition, soils excavation, concrete core drilling, and saw cutting. Contractor shall include all pertinent information with the Dig Notification Form and submit with detailed work plan fourteen (14) calendar days prior to desired digging activity.
 - 2. The Contractor shall contact USA North 811 prior to starting underground Work to locate existing underground utilities.
 - 3. Contractor shall mark locations of all known utilities on ground of dig area with marker paint.

4. Prior to commencement of digging activities, Contractor shall verify project inspector has inspected the dig site and confirmed the site marking as accurate, complete and in conformance with site utility plans.
 5. Contractor shall verify with University's Representative that all interested hospital departments have been notified of intent to begin digging operation.
 6. Record documents are required for dig activities. Contractor shall provide As-Built drawings.
- E. Shutdown Procedures: Contractor shall complete the UCDMC Request for Shutdown excel workbook and submit in excel file format in addition to a pdf packet containing any additional documents needed for coordinating the work, to the University for review and approval, the UCDMC Request for Shutdown excel workbook is included in pdf format at the end of this section. All five tabs in the UCDMC Request for Shutdown excel workbook must be filled out prior to submission. 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.
1. Contractor, including Subcontractor for the applicable impacted utility must attend a weekly RFS Review meeting with Plant Operations and Maintenance and the University Representative in person to review each submitted detailed MOP and Request for Support/Shutdown. Repeat meetings may be required if revisions to the MOP or RFS are required.
- F. The University does not normally charge for its shutdown support services. However, if poor planning and/or poor execution of a shutdown by the Contractor causes excessive time and effort for University personnel, the University reserves the right to back charge the Contractor for this effort required to support such shutdown.
1. Contractor shall verify with University's Fire Marshal that all appropriate Interim Life Safety Measures (ILSM) are in place.
 2. Contractor shall determine that proper and appropriate coordination and notification has been completed, including written authorization from University's Representative, prior to shut down.
 3. Service shutdowns shall require specific work plans to be submitted to and coordinated with University's Representative. Work Plan should reflect various work trades, activities or entities requiring active participation with University teams to coordinate 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. See attached Reintroduction of Existing Plumbing Lines and Fixtures for point of use taps that are used for a time period of at least 7 days and have not had any modifications, additions, or breaches withing the integrity of the domestic water line and are unable to be chlorinated using injection ports due to piping configuration. Domestic Water Flushing Logs must be completed as directed by the University's Representative.
- 5. 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 shall be prepared, at University written request, to perform certain shutdown and asbestos related work during non-normal time periods.
- G. Utility locations: Refer to Section 017600. General location of utility lines and services may be shown on the drawings or described elsewhere, University does not warrant the accuracy of the locations shown or described. Determination of the actual on-site locations of utility lines and services prior to the commencement of work shall be the responsibility of the Contractor. Contractor shall complete layout/research for Points of Connection (P.O.C.) and clean/prep piping at P.O.C. All capping, relocation or removal of such lines and services shall be performed by Contractor as a part of the Contract. New/continued piping and services installation shall be prefabricated and in place prior to the shutdown. All materials and tools required to complete the work must be at the shutdown location(s). Contractor shall not assume existing valves will hold 100%. Contractor is required to have at least one (1) alternate method (including parts and equipment) to complete installation once shutdown has started. Note: only wheel type cutters shall be used on copper pipe to reduce contamination to existing systems/valves.
- H. Detailed Work Plans: Contractor shall develop and submit for review and approval to University's Representative detailed work plans for specific work activities, both inside and outside the work area, associated with impact to, or interruption of services and operation, and dig activities. Work Plans shall be submitted as a PDF electronic file with Table of Contents indexed. Work Plans shall include written description of work activity, detailed schedule with proposed sequence of operation and activity duration, type of equipment to

be used, a copy of site plan highlighted to indicate sequencing and location of work and equipment, completed Request for Shutdown and/or Dig Notification forms as applicable, conformance to ILSM, and control methods for noise, vibration and airborne contaminants.

1. Work Plan submittal will not be accepted unless all required information is provided at time of submittal.
2. Submit Work Plan at least fourteen (14) calendar days prior to the commencement of any associated work activities.
3. Coordination/Engineering Drawings: Contractor shall provide a complete set of Coordination/ Engineering Drawings that indicates the architectural and structural building components; and combines all piping, conduits, fire sprinkler system, equipment, hangers, braces and other building components into one composite drawing for each floor, wing or area of work. Submit the Coordination/ Engineering Drawings as a bookmarked PDF electronic file. These drawings are for the Contractor's and University's use during construction and shall not be construed as replacing any shop drawings, "As-Built", or record drawings required elsewhere in the Contract Documents. University's review of these drawings is for design intent only and shall not relieve the Contractor of the responsibility for coordination of all work performed per the requirements of the Contract.
 - a. Contractor shall prepare and submit complete $\frac{1}{4}" = 1' - 0"$ coordination drawings, including plans, sections, details as are appropriate indicating the area layout, complete with debris removal area and materials access points, and all mechanical and electrical equipment in all areas and within above and below ceiling spaces for new and existing conditions, including bottom of all ducts, plenum, pipe and conduit elevations. Drawings shall show all structural and architectural components, restraints and other obstructions that may affect the work. Electronic or photo reproduction of University's Architectural Drawings is not acceptable.
 - b. Contractor and each Subcontractor shall ensure all relevant mechanical and electrical equipment, piping, conduit, fire sprinkler system, ceiling hangers, braces etc., are shown and will fit, together with necessary items such as lights, ducts, fans, pumps, piping, conduit and the like.
 - c. Contractor shall indicate all locations of expansion/ seismic joints and indicate how expansion for piping, conduit and other components is provided.
 - d. Contractor shall indicate all locations for access doors or other means of access at conditions above and below for items requiring access or service including but not limited to valves, mechanical equipment, electrical equipment valves and other components. The Contractor is responsible that piping, conduit, braces and other obstructions do not block access to items indicated above.
 - e. Submit completed and fully coordinated PDF electronic indexed file drawings with bookmarked Sheet Index together with Contractor's comments indicating possible areas of conflict for review to University's Representative prior to start of work.
 - f. Penetrations: Contractor shall prepare a sleeving layout ($\frac{1}{4}"$ 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) Excel Workbook PO&M Template
- B. Dig Notification Form
- C. 3.13.1 Reintroduction of Existing Plumbing Lines and Fixtures and Domestic Water Flushing Log

END OF SECTION 01 31 00

3.13.1 Reintroduction of Existing Plumbing Lines & Fixtures

For point-of-use taps that are unused for a time period of at least 7 days, and have not had any modifications, additions, or breaches within the integrity of the domestic water line and are unable to be chlorinated using injection ports due to piping configuration. If piping configuration includes chlorine injection ports, please follow steps in Water Safety Plan section 4.7.

Circumstances that may cause these conditions include but are not limited to the following: remodeling or construction activities, plumbing repairs, relocation of building occupants or patients, and patient rooms converted to office areas where plumbing is unused.

- 1 For domestic hot water taps, open fixture, then open the line isolation valve slowly. This will ensure one direction of flow and not allow backflow into the domestic hot water line. Flush fixture for at least 5 minutes until target temperature of 105 °F, not to exceed 120 °F. Follow Chlorine Residual Testing SOP 4.19 and record residual readings on Domestic Water Flushing Log 5.5, until a reading of .15 – .30 PPM of Chlorine Dioxide is reached or .5 – 2.0 PPM of Free Chlorine is reached. Log and date the results.
 - 1.1 Once the appropriate Chlorine residual is reached within the ranges list above. Shut of the fixture valves and then proceed to shut off the line isolation valve. Leaving the Residual Chlorine in the line.
 - 1.2 Repeat this process for a minimum of three days or at the direction of the Facility's Water Safety Team.
- 2 For domestic cold-water taps, open fixture, then open the line isolation valve slowly. This will ensure one direction of flow and not allow backflow into the domestic cold-water line. Flush the fixture for at least 5 minutes. Follow Chlorine Residual Testing SOP 4.19 and record residual readings on Domestic Water Flushing Log 5.5, until a reading of .15 – .30 PPM of Chlorine Dioxide is reached or .5 – 2.0 PPM of Free Chlorine is reached. Log and date the results.
 - 2.1 Once the appropriate Chlorine residual is reached within the ranges list above. Shut of the fixture valves and then proceed to shut off the line isolation valve. Leaving the Residual Chlorine in the line.
 - 2.2 Repeat this process for a minimum of three days or at the direction of the Facility's Water Safety Team.
- 3 At the direction of the Facility's Water Safety Team, consider testing for Legionella at patient-care buildings that are 2 or more stories high at a minimum of 2 locations per distribution loop of affected water service. For patient care buildings that are single story, consider sampling at 1 location per distribution loop of affected water service. (Hot and/or cold water depending on the source of disruption).

Domestic Water Flushing Log

☐ Routine
 Incident/Reintroduction ☐

Date	Bldg.	Location/Room	Description of Fixture	Flush Time	Residual Reading	Temp.	pH	Performed By:

Date	Bldg.	Location/Room	Description of Fixture	Flush Time	Residual Reading	Temp.	pH	Performed By:

[illegible]

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

PROJECT NAME: UCDH PROJECT NAME
CONTRACTOR: NAME OF CONTRACTOR PERFORMING RFS
SUPERINTENDENT: SUPERINTENDENT NAME
UCDH RFS #: UCDH RFS (This is the tracking number the CM uses)
GC/PRIME CONTRACTOR RFS#: CONTRACTOR RFS

OSHPD PROJECT #: OSHPD PROJECT # OR UCDH PROJECT #
PROJECT MANAGER: PROJECT MANAGER
FOREMAN: FOREMAN
BEAT W.O.#: BEATS W.O.#

TODAY'S DATE: TODAY'S DATE
REQUEST DATE: REQUEST DATE
REQUESTED BY: REQUESTED BY

SUPPORT DATE: SUPPORT DATE
SUPPORT TIME: SUPPORT TIME
REQUESTER'S PHONE NUMBER: REQUESTER'S PHONE NUMBER

TO: UCDH PO&M

FROM: (Indicate the following: General/Prime Contractor company Name, address, contact phone.)
(General or Prime)

ATTENTION: (Who from PO&M will be reviewing this RFS?)

Shutdown Work: Indicate
(Utility Specific)

Subcontractor performing the Shutdown: Indicated Subcontractor(s) involved with the shutdown here

Scope:
(Brief Description of Work)

Area Impacted
(identifies the work area and departments that will need to review)

Departments to Review	Mechanical	Electrical	Plumbing	Fire Alarm	Security/Communications (UCDH Police/Security)	IT

End Users that will be impacted:	End User Name	End User Phone	End User E-mail	Contacted? Yes/No
Contact for Department:				

Additional Comments:

METHOD OF PROCEDURE

PROJECT NAME: UCDH PROJECT NAME
CONTRACTOR: NAME OF CONTRACTOR PERFORMING RFS
SUPERINTENDENT: SUPERINTENDENT NAME
UCDH RFS #: UCDH RFS (This is the tracking number the CM uses)
GC/PRIME CONTRACTOR RFS#: CONTRACTOR RFS

OSHPD PROJECT #: OSHPD PROJECT # OR UCDH PROJECT #
PROJECT MANAGER: PROJECT MANAGER
FOREMAN: FOREMAN
BEAT W.O.#: BEATS W.O.#
(This section is Auto-populated from "RFS TAB")

TODAY'S DATE: TODAY'S DATE
REQUEST DATE: REQUEST DATE
REQUESTED BY: REQUESTED BY
APPROVED BY:

SUPPORT DATE: SUPPORT DATE
SUPPORT TIME: SUPPORT TIME
REQUESTER'S PHONE NUMBER: REQUESTER'S PHONE NUMBER
APPROVER DATE:

TO: UCDH PO&M Team

FROM:

PERSONNEL CONTACTS:	NAME	COMPANY	TITLE	PHONE NUMBER

DETAILED DESCRIPTION OF WORK:**SAFETY REQUIREMENTS:**

1
2
3
4
5
6

* List safety requirements that are determined by the "Task Hazard Analysis" such as: LOTO, Confined Space, Fall Protection, Etc..

REQUIRED TOOLS:

	<u>EEWP only</u>	
	Check-In	Check-Out
1		
2		
3		
4		
5		
6		
7		

	<u>EEWP only</u>	
	Check-In	Check-Out
8		
9		
10		
11		
12		
13		
14		

* List tools necessary to perform the work including: Hand tools, Equipment, Radios, Safety Eq, Test Eq, Back-up Tools, Etc..

PERSONNEL REQUIRED:

1	
2	
3	
4	
5	

6	
7	
8	
9	
10	

METHOD OF PROCEDURE

PROJECT NAME: UCDH PROJECT NAME _____ CONTRACTOR: NAME OF CONTRACTOR PERFORMING RFS _____ SUPERINTENDENT: SUPERINTENDENT NAME _____ UCDH RFS #: UCDH RFS (This is the tracking number the CM uses) _____ GC/PRIME CONTRACTOR RFS#: CONTRACTOR RFS _____	OSHPD PROJECT #: OSHPD PROJECT # OR UCDH PROJECT # _____ PROJECT MANAGER: PROJECT MANAGER _____ FOREMAN: FOREMAN _____ BEAT W.O.# BEATS W.O.# _____ (This section is Auto-populated from "RFS TAB")

PRE-TASKS

Item	Action	Responsible Party	Location	Date	Time of Day	Duration (in min)	Completed Date to be filled out during procedure	DESCRIPTION
Pre-Task 1	Pre-Task		Pre work	TBD	TBD			
Pre-Task 2	Pre-Task		Pre work	TBD	TBD			
Pre-Task 3	Pre-Task		Pre Work	TBD	TBD			
GO / NO GO CONDITIONS								
	<u>Go / No go condition(s):</u>			<u>Description / Impact</u>			GO ☐ / NO-GO ☐	
1)							GO ☐ / NO-GO ☐	
2)							GO ☐ / NO-GO ☐	
3)							GO ☐ / NO-GO ☐	
4)							GO ☐ / NO-GO ☐	
5)							GO ☐ / NO-GO ☐	

TASKS

Task 1								
Task 2								
Task 3								
Task 4								
Task 5								
Task 6								
Task 7								
Task 8								
Task 9								
Task 10								

Item	Action	Responsible Party	Location	Date	Time of Day	Duration (in min)	Completed Date to be filled out during procedure	DESCRIPTION
Task 11								
Task 12								
Task 13								
Task 14								
Task 15								
Task 16								
Task 17								
Task 18								
Task 19								
Task 20								
Task 21								
BACKOUT PROCEDURES								
1)	Example 1: Replace covers on all equipment locations							
2)	Example 2: Remove Material, Equipment and tools							
3)	Example 3: Restore area to condition in which it was found.							
4)								
5)								

	PROJECT NAME:	UCDH PROJECT NAME	OSHDP PROJECT #:	OSHDP PROJECT # OR UCDH PROJECT #					
	CONTRACTOR:	NAME OF CONTRACTOR PERFO		PROJECT MANAGER:					PROJECT MANAGER
	SUPERINTENDENT:	SUPERINTENDENT NAME		FOREMAN:					FOREMAN
	UCDH RFS #:	UCDH RFS (This is the tracking		BEAT W.O.#					BEATS W.O.#
	GC/PRIME CONTRACTOR RFS#:	CONTRACTOR RFS		(This section is Auto-populated from "RFS TAB")					
No.	Contractor				Power Analysis		Notes		
	Construction Task (if power needed for task)	Room No.	Power Equipment / Tool	Rated Amps	Panel / Circuit	Amperage (PO&M)	PO&M Tech	Notes	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

	PO&M Signature (Superintendent or PO&M CM)
Name	
Signature	

METHOD OF PROCEDURE

PROJECT NAME:	UCDH PROJECT NAME	OSHPD PROJECT #:	OSHPD PROJECT # OR UCDH PROJECT #
CONTRACTOR:	NAME OF CONTRACTOR PERFORMING WORK	PROJECT MANAGER:	PROJECT MANAGER
SUPERINTENDENT:	SUPERINTENDENT NAME	FOREMAN:	FOREMAN
UCDH RFS #:	UCDH RFS (This is the tracking number)	BEAT W.O.#	BEATS W.O.#
GC/PRIME CONTRACTOR RFS#:	CONTRACTOR RFS	(This section is Auto-populated from "RFS TAB")	

By signing below you acknowledge that you have reviewed all safety procedures and Method of Procedures for MOP #____, dated_____, in your presence and that you understand and agree with all safety procedures the method of procedures written and reviewed therein.

[illegible]

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

FROM: _____

Project Manager's email address: _____

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. Electrical, mechanical and equipment items other than those covered by item "a" above: 60 calendar days.
 - c. 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 calendar days, the Contractor and the University's Representative shall meet to review the Construction CPM Schedule and discuss any changes required.
- C. The Contractor shall then revise and resubmit (if required) the Updated Contract Schedule and Application for Payment to the University's Representative for payment approval.
- D. The monthly update shall be calculated using retained logic with a required finish date specified as the current contract completion date. Progress Override calculations shall not be acceptable.
- E. No Applications for Payment will be processed, nor shall any progress payments become due until updated Contract Schedules are accepted by University's Representative. The accepted, updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis for payment during that period. Acceptance of any updated Contract Schedules shall not relieve Contractor from its responsibility to fully complete the Contract within the Contract Time, nor shall it relieve Contractor from sole responsibility for any errors in the updated Contract Schedules.
- F. Contractor shall perform the Work in accordance with the updated Contract Schedule. Contractor may change the Contract Schedule to modify the order or method of accomplishing the Work only with prior agreement by the University.
- G. With each monthly updated Contract Schedule, the Contractor shall provide an accompanying narrative describing the progress anticipated during the upcoming month, critical activities, delays encountered during the prior month, delays anticipated during the upcoming month, and an audit of the Contract Time. The audit shall show current days allowed by contract, days used through the end of the month, days remaining, percent of time used to date, and percent complete as measured by cost loaded schedule, and days ahead of or behind schedule. In the event that the Contractor was delayed by any occurrence during the prior month, the narrative report shall include a listing of all delays that affected the critical path and shall clearly explain the impact the claimed delay(s) had on the critical path and shall include an accounting of days lost or gained.

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

3.05 LOOK AHEAD SCHEDULES

- A. Look Ahead Schedule is a schedule derived from the Contract Schedule (or the most current monthly update of the Contract Schedule) which indicates in detail all activities scheduled or worked on for the 1 prior weeks, and all activities scheduled to occur during the next 3 weeks.
- B. Provide detailed Look Ahead Schedules every week.
- C. Submit in 11-inch by 17-inch Gantt chart format.
- D. Look Ahead Schedule shall be generated from the then current Preliminary Contract Schedule, Contract Schedule, or updated Contract Schedule. Activities listed in the Look Ahead Schedule shall reference the activity identification or other such coding for correlation to the activities listed in the Contract Schedule.

3.06 TIME EXTENSION REQUEST DOCUMENTATION

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

3.07 AS BUILT SCHEDULE

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

3.08 WEATHER DAYS ALLOWANCE

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

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

END OF SECTION 01 32 00

SECTION 01 32 20

CONSTRUCTION PROGRESS REPORTING

PART I - GENERAL

1.01 SUMMARY

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

1.02 PROGRESS PHOTOS/VIDEOS

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

1.03 AS-BUILT DOCUMENTATION

- A. The Contractor shall be responsible for the maintenance and completion of As-Built Documents the following procedure shall be strictly adhered to:
 - 1. Contractor shall download and save all of the construction documents. This set of Drawings along with the Specifications, shall be kept on file available to University's Representative's until the completion of the Project.
 - 2. As the Work progresses, a complete and accurate notation of all documented changes or deviations from the Drawings and Specifications shall be recorded thereon in the As-built Documents by the Contractor. Such indications shall be neatly made and kept current.
 - 3. Do not complete Work or request inspections if such Work has been installed in locations contrary to the Drawings.
 - 4. At the completion of the Project, Refer to Section 017800 CLOSE OUT SUBMITTALS.

PART II - PRODUCTS – Not applicable to this section.

PART III - EXECUTION

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

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 – 2.1 Re-submittal of second submittal for Section 092500 – Gypsum Board

4. 092500 – 2.2 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

SECTION 01 34 00

CONTRACTOR(S) EMERGENCY PROCEDURES

PART I - GENERAL

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

PART II - DEFINITIONS

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

PART III - PROCEDURES

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

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

1. Emergency Telephone Numbers

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

END OF SECTION 01 34 00

SECTION 01 35 00

SPECIAL PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

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

1.03 INTERIM LIFE SAFETY MEASURES (ILSM)

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

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

Any minor life safety code deficiency that could be corrected within 45 calendar days that is confined to a single smoke compartment or fire zone would require reduction in flammable and combustible loads in the affected smoke compartment or zone as well as issuing a work order to complete the Plan For Improvement (PFI) within 45 calendar days of discovery.

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

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

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

1. ILSM example #1: Ensure exits provide free and unobstructed egress. Maintain free and unobstructed access and exits from all buildings to public ways. Maintain escape facilities for construction workers at all times. Inspect means of egress in construction areas daily.
2. ILSM example #2: Maintain free and unobstructed access to emergency departments/services.
3. ILSM example #3: Ensure fire alarm, detection, and suppression systems are not impaired.

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

1.04 SECURITY PROCEDURES

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

paint, lead lining in walls or glass windows, lead in ceramic products, mold, water leaks or other hazardous materials or conditions, the Contractor shall immediately stop work in the affected area and report the condition to University's Representative in writing. The work in the affected area shall not thereafter be resumed except by written agreement of University and Contractor if in fact the material is identified as hazardous and has not been rendered harmless. The work in the affected area shall be resumed in the absence of hazardous materials, or when such materials have been rendered harmless.

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 35 00

Fire Marshal's Office Signature: _____
Date: _____



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



Interim Life Safety Measure (ILSM) Impact Worksheet

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

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

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



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



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

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

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

Requestor's Signature

Date

UCDH Fire Marshal's Office Representative

Date

Information:

[illegible]

SECTION 01 39 00
GREEN BUILDING POLICY IMPLEMENTATION

PART I – GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED DOCUMENTS AND SECTIONS

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

1.03 FUNDAMENTAL BUILDING SYSTEMS COMMISSIONING

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

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

1.04 CONSTRUCTION WASTE MANAGEMENT: DIVERT 80% FROM LANDFILL

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

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

D. PROJECT MEETINGS

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

E. PROJECT CONDITIONS

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

F. CONSTRUCTION WASTE RECYCLING SERVICES

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

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

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

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

H. WASTE MANAGEMENT PLAN IMPLEMENTATION

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

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

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

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

2. Source Control

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

3. Housekeeping

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

4. Scheduling

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

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

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

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

5. Building Flush-Out

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

PART II – PRODUCTS – Not Applicable to this section

PART III – EXECUTION

3.01 Refer to the following attachments

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

END OF SECTION 01 39 00

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

PROJECT TITLE: _____

COMPANY: _____

DATE: _____

		TOTAL AMOUNT GENERATED	AMOUNT RECYCLED	AMOUNT SALVAGED	AMOUNT LANDFILLED
MATERIAL	DESTINATION	TONS	TONS	TONS	TONS
TOTALS					

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

PROJECT TITLE: _____

COMPANY: _____

LOG DATES: _____ through _____

Date	Material	Destination	Tons			
			Salvaged	Recycled	Landfilled	Total
Totals						

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

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

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

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

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

1.04 APPLICABLE CODES, LAWS AND ORDINANCES

A. Building Codes, Laws, and Regulations:

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

a. California Code Series - 2022 Edition

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

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

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

- 4) NFPA 80 – Standard for Fire Doors and Other Opening Protectives
 - 5) NFPA 99 – Health Care Facilities Code
 - 6) NFPA 101 – Life Safety Code
 - 7) NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
 - 8) NFPA 701 – Standard Methods of Fire Tests of Flame Propagation of Textiles and Films
 - c. California Code of Regulation Series (embodied in California model codes as noted above)
 - 1) Title 8, Industrial Relations
 - 2) Title 17, Public Health (Chapter 7)
 - 3) Title 19, Public Safety
 - 4) Title 21, Public Works
 - 5) Title 22, Social Security
 - 6) Title 24, Parts 1, 2, 3, 4, 5, 9 and 12
 - 7) Title 25, Energy Insulation Standards
 - d. Americans with Disabilities Act (ADA) 2010 (Federal Law)
 - e. Rules and regulations of private and public utilities
 - f. American National Standards Institute (ANSI)
 - g. American Society of Testing Materials (ASTM)
 - h. Federal Specifications (Fed. Spec.)
 - i. Underwriters Laboratories
 - j. Traffic controls per California MUTCD requirements
2. All dates to comply with editions adopted and accepted by University and California State Fire Marshal (CSFM).
 3. Unless otherwise specified, specific references to codes, regulations, standards, manufacturers' instructions, or requirements of regulatory agencies, when used to specify requirements for materials or design elements, shall mean the latest edition of each in effect at the date of submission of bids, or the date of the Change Order, as applicable.

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

1.05 PROJECT INSPECTIONS

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

1.06 DEPARTMENT OF HEALTH CARE ACCESS AND INFORMATION PROJECTS

- A. Department of Health Care Access and Information (HCAI) is the agency having jurisdiction over all acute care medical project design and construction unless a Memorandum of Understanding (MOU) has been established assigning University staff to perform regulatory duties.
- B. HCAI will approve an inspector for the Project who shall have full access to the Project at all times.
- C. HCAI will require Verified Report forms to be filed per testing, inspection and observation form during construction and a final verified report at completion of the project. Separate verified reports are required from Consultants, Project Inspector, and Contractor.
- D. HCAI will require a Building Permit for project submitted by University's Representative. No HCAI Building Permit fees are required to be paid by the Contractor.
- E. HCAI will require Change Order Approval submitted by University's Representative.
- F. HCAI will require a Licensed Contractor's Declaration from the Contractor.
- G. HCAI projects shall comply with the 2022 California Administration Code.

1.07 DEFERRED APPROVAL

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 41 00

SECTION 01 42 00

REFERENCES

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. **University-Furnished/University-Installed (UFUI):** Items, systems, or equipment furnished by the University at its cost and installed by the University as part of the work.
 - 7. **University-Furnished/Vendor-Installed (UFVI):** Items, systems, or equipment furnished by the University at its costs and installed by the vendor as part of the work.

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8. Construction Site: Same as site.

9. 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.
10. Equal or Equivalent: As determined by the University's Consultant as being of the same quality, appearance, utility, durability, finish, function, suitability, and performance.
11. Furnish: Means "supply and deliver, ready for unloading, unpacking, assembly, installation, and similar operations".
12. 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.
13. Install: Describes operations at the site including unloading, unpacking, assembly, erection, anchoring, applying, working to dimension, protecting, cleaning, and similar operations.
14. 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.
15. Jobsite: Same as site.
16. 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.
17. Noted: Same as indicated.
18. Owner-Furnished/ Contractor-Installed (OFCI): Item, system or equipment furnished by University at its cost and installed by the Contractor as part of the Work.
19. Per: In accordance with or in compliance with.
20. Products: Materials, systems or equipment.
21. Project site: Same as site.

22. 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.
23. Provide: Means "furnish and install, complete and ready for use".
24. 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.
25. 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.
26. Scheduled: Same as indicated.
27. 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.
28. Shown: Same as indicated.
29. 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.
30. Testing Laboratories: Same as Testing and Inspection Agency.
31. 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.
32. 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 QUALITY CONTROL

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

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

1.04 QUALITY OF THE WORK

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

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

1.05 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

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

1.06 INSPECTIONS AND TESTS BY SERVING UTILITIES

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

1.07 INSPECTIONS AND TEST BY MANUFACTURER'S REPRESENTATIVES

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

1.08 INSPECTION BY INDEPENDENT TESTING AND INSPECTION LABORATORIES

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

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

List the applicable services required, for example:

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

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

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

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

1.09 CONTRACTOR RESPONSIBILITIES IN INSPECTIONS AND TESTS

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

1.10 CONTRACTOR RESPONSIBILITIES REGARDING UNIVERSITY TESTING LABORATORY

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

1.11 TEST REPORTS

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

- B. University will distribute one (1) PDF electronic copy of the reports to University's Consultants and Contractor.

1.12 GEOTECHNICAL ENGINEER (If applicable or NOT USED)

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 45 00

SECTION 01 45 10

SEISMIC CONTROL – HCAI

PART I - GENERAL

1.01 DESCRIPTION

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

1.02 QUALITY ASSURANCE

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

1.03 SUBMITTALS

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

PART II - PRODUCTS

2.01 SEISMIC RESTRAINT REQUIREMENTS

A. SUMMARY

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

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

B. SEISMIC RESTRAINT DESIGN

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

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

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

C. ACCEPTABLE MANUFACTURERS

1. HCAI Pre-approved Certified Manufacturer (OPM)

D. ANCHORS, INSERTS AND FASTENERS

1. All anchors, inserts, fasteners, or connections to the structure shall be submitted to the structural engineer of record for review and acceptance prior to installation.
2. Do not use any anchor or insert in concrete or metal decking with concrete fill, which does not have one of the following:
 - a. ICC evaluation report
 - b. HCAI pre-approval
3. Cast-in-place inserts that contain internal threads shall include the installation of a jam or lock nut to secure the connection of the vertical support rod to the cast-in-place insert.
4. Cast-in-place inserts that allow for horizontal adjustment shall not be allowed unless an engineered solution is provided to assure positive captured positioning and secured attachment.
5. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or internally threaded anchors in concrete or metal decking with concrete fill without prior scanning of the slab and wall for clearances, and to prevent damages to embedded electrical conduits and/or mechanical piping and reinforcing steel.
6. All beam clamps shall be constructed of malleable iron or steel. All single flange mounted beam clamps shall include a retaining strap or J-hook and must be submitted to the project structural engineer of record for review and acceptance prior to installation. Beam clamps shall not be used to resist seismic loads.

E. FIELD QUALITY CONTROL

1. Inspection of seismic restraints by the Inspector of Record (IOR), and/or Authority Having Jurisdiction (AHJ).
2. Special inspection for special seismic certification per CBC 1705A.12.4.

PART III - EXECUTION

3.01 SEISMIC ANCHORING AND RESTRAINTS

A. Equipment anchors:

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

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

3.02 INSTALLATION AND TESTING OF MECHANICAL ANCHORS:

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

END OF SECTION 01 45 10

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 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 use the official University Representative Procore project Inspection tool for all Inspection Requests and documentation; if the IOR does not want to utilize Procore, the Contractor will need to fill out Inspection Request Form for all inspections. Process will be confirmed when the IOR is identified for the project.
1. Contractor shall properly plan and coordinate inspection requests. Schedule delays caused by Contractor's failure to plan and/or coordinate inspection requests will not be considered for adjustments to Contract Time or Contract Sum.
 2. A complete set of HCAI/SFM stamped and approved Contract Drawings and Contract Specifications, including applicable shop drawings and building permit shall be available on site for review by the Inspector-of-Record. The Contractor, Subcontractors and other responsible parties shall be present during inspection walk-throughs. All areas of project scope shall be ready and accessible for inspection. Contractor shall provide access equipment as applicable for the inspector's needs.
 3. A complete set of codes referred to in the approved plans must be maintained on the job at all times.
 4. Contractor shall submit verified compliance reports as outlined in the California Administrative Code, Section 7-151.

1.05 SCHEDULING INSPECTIONS – NOTIFICATION REQUIREMENTS

- A. Advance Inspection Notification: University's Representative for this project requires the following advance notifications to schedule appropriate inspection agencies at the project site.
1. IOR Inspection Request Notification: Forty-eight (48) hours. Note: Inspection requests received after 2:00 PM will be considered received on the following day; (example: Inspection request received at 2:01 PM on a Monday would be scheduled for inspection on Thursday). Weekend and off-hours inspection requests will be scheduled on a case-by-case basis with a minimum of seventy-two (72) hour inspection request notification.
 2. HCAI Field Compliance Inspectors: Fourteen (14) calendar days.
 3. Testing Laboratory Inspections: Seventy-two (72) hours.
 - a. All testing laboratory and testing procedures must be scheduled by University's Representative. Inspections and/or testing directly scheduled by Contractor will not be accepted.
 - b. Contractor will bear all costs associated with unauthorized inspections and testing.
 4. State Fire Marshal Inspection Request Notification: Five (5) working days.

B. Methods of Inspection Notification:

1. All inspection notifications shall be in writing using inspection tool on Procore or the 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.

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

D. Re-inspections:

1. More than two (2) re-inspections: The cost of re-inspections of the same work, more than twice, shall be deducted from Contract Sum. University will provide itemized invoice for Contractor's records.
2. Work unprepared for inspection: Re-inspections of the same work scheduled by Contractor, but not ready for inspection will be identified as a re-inspection.

PART II - PRODUCTS – Not Applicable to this Section.

PART III - EXECUTION

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

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

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

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

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

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

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

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

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

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

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

3.05 EMERGENCY LIGHTING

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

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

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

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

A. Mechanical Equipment Requirements

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

B. Mechanical Testing

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

C. Boilers

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

D. Ducts

- 1. Installation - Bracing (Part 4, Section 604.1.4)
- 2. Fire Damper test log from IOR (Part 4, Section 606.2).

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

E. HVAC Unit Testing

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

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

A. Piping Systems (Title 24, Part 5)

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

B. Water Heater Testing

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

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

1. Pressure test - 150 psig - Oxygen, Medical Air & Nitrous Oxide (4-3.4.1.2).
2. Pressure test - 200 psig - Nitrogen (4-5.1.3.4).
3. 24-hour pressure test - 60 psig - Vacuum system (4-10).
4. 24-hour pressure test - 20% over operating pressure [A-4.3.4.1.2 (b)(e)].
5. Alarm test for system [4-3.4.1.3 (d)].
6. Area Valves, location, labeled, alarms tested (4-4.1 & 4-5.1.4).

7. Laboratory testing affidavits - welding/brazing (4-6.2.3.3).
8. Verified Medical Air Quality - Installation and 24 hour later.
9. Certification of system (Purity, Cross Connection, Alarms, Etc.) [4.5].
10. Certification of Bulk System [NFPA 50 (Oxygen) & CGA G-8.1 (Nitrous Oxide)].
11. Approved drawings and documents for submittal to University's Representative for permanent records).

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

A. Main Panel/Service

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

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

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

C. General Electrical Requirements

1. Working space/Headroom [Table 110-26(a); 110-33; 110-34].
2. Circuits and lights tested (410-45).
3. Receptacle polarity and grounding [200-10(b)].
4. Isolated ground monitor test [517-160(b)].
5. Motor load current adjustment.

6. Identification and Labeling of equipment (110-21; 110-22).
7. Identify circuits (Critical Care Areas) (517-19).

D. Miscellaneous Electrical Requirements

1. Test logs from Contractor and Inspector-of-Record.
2. Electrical Engineer-of-Record acceptance of system.
3. Owner In-Service training on Equipment.
4. Equipment Manuals and Instruction to Owner.
5. Warranties and Equipment Certification.
6. As-Built documents to Owner.

3.10 FIRE MARSHAL INSPECTION REQUIREMENTS

A. Framing Inspections

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

B. Fire-Rated Partition Locations

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

C. Close-In Inspections

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

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

D. Final Construction Inspections

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

3.11 HCAI – Testing, Inspection and Observation (TIO)

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

3.12 Refer to the following attachment

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

END OF SECTION 01 45 50

INSPECTION REQUEST

Project #: _____ HCAI #: _____ UCDH IR #: _____ Contractor IR #: _____ Date: _____
Project _____ Spec Section _____

Name: _____ (s): _____

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

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

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

Type of Inspection: _____

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

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

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

Signed: _____ Date: _____

UNIVERSITY USE ONLY

Date Received: _____ Time of Inspection: _____

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

Inspector Arrival Time: _____ Inspector Departure Time: _____

Comments: _____

☐ Approved ☐ Approved as Noted ☐ Not Approved ☐ Cancelled

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

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

NON-CONFORMING WORK NOTICE

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

To: <u>[PROJECT MANAGER NAME/EMAIL]</u> <u>[DESIGN PROFESSIONAL NAME/EMAIL]</u> <u>[IF HCAI PROJECT, AREA COMPLIANCE OFFICER/EMAIL]</u> _____ _____	From: UC Davis Health IOR Facilities Design & Construction – Inspection Group 4800 2 nd Avenue, 2 nd Floor Sacramento, CA 95817 P: 916-734-5060

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

Detail: _____

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

Reported by: _____

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

Description of corrective action taken: _____

Accepted by: _____ Date: _____

CC:



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

This program is prepared and submitted for an OSHPD 1 project. OSHPD 1 projects include all construction and remodel projects for: general acute care hospitals, acute psychiatric hospitals, and general acute care hospitals providing only acute medical rehabilitation center services (2022 CBC 1224.1).

SECTION A		PROJECT INFORMATION	
Facility #:	Facility Name:		Project #:
10619	University of California Davis Medical Center		S241013-34-00
Street Address:	2315 Stockton Boulevard		
City:	Sacramento	County:	Sacramento
Record Name (Scope of Project):		9558910 - DAVIS TOWER #0711 & 0762 PHARMACY REMODEL	
Abbreviations: CAC: California Administrative Code AAMA: American Architectural Manufacturers Association CBC: California Building Code NFPA: National Fire Protection Association CEC: California Electrical Code FM: FM Approval Standards CMC: California Mechanical Code DPOR: Design Professional of Record CPC: California Plumbing Code			
			Version: R04.37

Testing, Inspection, and Observation Stages

Stage No.	Stage Name	Stage Scope / Description
1	Phase 1	Remodel of Non-sterile Compounding Room [0711A] and building of Staff Lounge [0779]
2	Phase 2	Remodel of Narc Pharmacy [0762H] and Multi-User Toilet Rooms [0784 & 0786]
3	Phase 3	Remodel of Offices [0711C & 0715A], remodel of Hallway [0715], and building of Office [0715B], Receiving Area [0776], & HD Drug Storage [0778]

DESIGN PROFESSIONAL OF RECORD RESPONSIBILITY

The administration of the work of construction, including this TIO, shall be under the responsible charge of an architect and structural engineer. When a structural engineer is not substantially involved, the architect shall be solely responsible. Where neither structural nor architectural elements are substantially involved, a mechanical or electrical engineer registered in the branch of engineering most applicable to the project may be in responsible charge. (CAC 7-141(a))

Note: HCAI plan review staff must provide verification that the TIO program has been "Reviewed" prior to plan approval to confirm the applicability of the tests and inspections identified in the TIO program for work scope, building systems, and the construction materials shown in the design drawings. Field staff will issue subsequent "TIO Program Approval".

The "TIO Program Approval" from HCAI field staff must be obtained and included with the notice of start of construction required by CAC Section 7-137(a)4) and 7-145(a)5.A)

Construction shall not commence until the health facility has obtained from HCAI "TIO Program Approval". (CAC Section 7-135(a)3)



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION B					NOTE: Approved agencies, individuals, and all changes to the TIO program shall be identified, evaluated by the DPOR and approved by HCAI prior to proceeding with the related work.				
Facility #:		Facility Name:			Project #:				
10619		University of California Davis Medical Center			S241013-34-00				
					Select with "X" or provide required OPAA information:				
Index #	Stage 1 Required (Select with "X")	Stage 2 Required (Select with "X")	Stage 3 Required (Select with "X")	TESTS	Samples of Test & Inspection Reports Included	OPAA No. and Expiration Date	Responsible Approved Agency And/Or Individual (Identify Individual)	Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)

STRUCTURAL TESTS

Concrete

B-C1	X	X	X	Concrete CBC 1705A.3, 1903A.6 & 1910A.1; ACI 318 1.9.1 & 26.4.1.1 Cementitious materials					
B-C2	X	X	X	Concrete CBC 1705A.3, 1903A.5; ACI 318 1.9.1 & 26.4.1.2 Aggregates/Reactive aggregates					
B-C3	X	X	X	Concrete CBC 1705A.3; ACI 318 26.4.1.4; ASTM C1602 Water					
B-C4	X	X	X	Concrete CBC 1705A.3 & 1905A.1.17; ACI 318 26.12 Strength test					
B-C13	X	X	X	Post-installed anchors CBC 1910A.5 Installation verification test (includes adhesive, shot pins and mechanical anchors)					

ELECTRICAL TESTS

B-E1	X	X	X	Ground Fault Protection of Equipment CEC 230.95(C) & 517.17(D)					
B-E6	X	X	X	Hospital Grade Receptacles 2021 NFPA 99 6.3.3.2.5					
B-E7	X	X	X	Isolated Power Systems – Line Isolation Monitor Test 2021 NFPA 99 6.3.3.3.2					
B-E8	X	X	X	Isolated Power Systems – Impedance of Isolated Wiring Test 2021 NFPA 99 6.3.2.9.2.1					
B-E12	X	X	X	Torque Electrical Connections CEC 110.3(B) & 110.14(D)					

MECHANICAL TESTS

B-ME1	X		X	Listed Hood Assemblies CMC 508.2					
B-ME8	X	X	X	Hydronics CMC 1205.2, 1220.4.6 & 1221.3 Pressure test of steam and water piping					
B-ME10	X	X	X	Pre-Demolition Air Balance CMC 407.3.1 Pre-demolition air balance test and report					
B-ME11	X	X	X	Post-Demolition Air Balance CMC 407.3.1 Air balance test and report					
B-ME12	X	X	X	Ventilation System Air Balance CMC 407.3.1 & Table 4-A Areas tested and balanced					
B-ME13	X	X	X	Duct Leakage Test CMC 603.9.2 SMACNA HVAC air duct leakage test					

PLUMBING TESTS

B-P1	X	X	X	Disinfection of Potable Water Systems CPC 609.10					



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION B				NOTE: Approved agencies, individuals, and all changes to the TIO program shall be identified, evaluated by the DPOR and approved by HCAI prior to proceeding with the related work.					
Facility #:		Facility Name:		Project #:					
10619		University of California Davis Medical Center		S241013-34-00					
				Select with "X" or provide required OPAA information:					
Index #	Stage 1 Required (Select with "X")	Stage 2 Required (Select with "X")	Stage 3 Required (Select with "X")	TESTS	Samples of Test & Inspection Reports Included	OPAA No. and Expiration Date	Responsible Approved Agency And/Or Individual (Identify Individual)	Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)
B-P8	X	X	X	Existing Sewers and Drains CPC 102.4.1, 105.3, & 712.0 Tested for conformance with requirements for new work					
B-P9	X	X	X	Water Supply System CPC 105.3 & 609.4 Pressure tested prior to covering or concealment					
B-P10	X	X	X	Plumbing, Drainage, and Venting Systems CPC 105.3 & 712.0 Water or air tested prior to use, covering or concealment. No air test for plastic piping.					
FIRE PROTECTION AND LIFE SAFETY SYSTEMS									
B-FP1	X	X	X	Fire Alarm CFC 901.5 & CFC 907.7 NFPA 72-2022 §14.4 Acceptance and reacceptance testing					
B-FP5	X	X	X	Fire Sprinkler CFC 901.5 & NFPA 13-2022 Chapter 29 Above ground piping acceptance testing					

00112



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION C					NOTE: Approved agencies, individuals, and all changes to the TIO program shall be identified, evaluated by the DPOR and approved by HCAI prior to proceeding with the related work.				
Facility #:		Facility Name:			Project #:				
10619		University of California Davis Medical Center			S241013-34-00				
					Select with "X" or provide required OPAA information:				
Index #	Stage 1 Required (Select with "X")	Stage 2 Required (Select with "X")	Stage 3 Required (Select with "X")	ON-SITE SPECIAL INSPECTIONS	Samples of Test & Inspection Reports Included	OPAA No. and Expiration Date	Responsible Approved Agency And/Or Individual (Identify Special Inspector)	Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)
STRUCTURAL SPECIAL INSPECTIONS									
Concrete									
C-C1	X	X	X	Concrete CBC 1705A.3; ACI-318 26.5.2 & 26.13 Placement of concrete					
C-C2	X	X	X	Concrete CBC 1705A.3; ACI-318 26.4.1.5 Admixtures					
C-C3	X	X	X	Concrete CBC 1705A.3; ACI-318 26.4 Mix design					
C-C4	X	X	X	Concrete CBC 1705A.3; ACI-318 26.13 Reinforcing steel & prestressing steel					
C-C5	X	X	X	Concrete CBC 1705A.3 CIP & post-installed anchors					
Steel									
C-S2	X	X	X	Steel CBC 1705A.2.5 Field welding					
C-S3	X	X	X	Steel AWS D1.1 3 & 4 & AWS D1.8 6.1 Field welding - WPS / WPQR					
Nonstructural components, supports and attachments									
C-N1	X	X	X	Architectural components CBC 1705A.13.5 & 1705A.17 Cladding, nonbearing walls, and veneer					
C-N2	X	X	X	Ceiling CBC 1705A.13.5 Suspended ceiling systems and their anchorage					
C-N5	X	X	X	Plumbing, mechanical and electrical components CBC 1705A.13.6 Anchorage, bracing, and vibration isolators					
C-N6	X	X	X	Special Seismic Certification CBC 1705A.13.4 Special seismic certification label, anchorage, and mounting					
ELECTRICAL INSPECTIONS									
C-E2	X	X	X	Essential Electrical System Adjustable Circuit Breaker Selection and Settings per Approved Coordination Study CEC 517.31(G)					
FIRE PROTECTION AND LIFE SAFETY SYSTEM SPECIAL INSPECTIONS									
C-FP3	X	X	X	Penetration Firestops CBC 1705A.18.1 Penetration firestop systems that are tested and listed					
C-FP4	X	X	X	Fire-Resistant Joint Systems CBC 1705A.18.2 Fire-resistant joint systems that are tested and listed					
OTHER SPECIAL INSPECTIONS									



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION C					NOTE: Approved agencies, individuals, and all changes to the TIO program shall be identified, evaluated by the DPOR and approved by HCAI prior to proceeding with the related work.				
Facility #:		Facility Name:			Project #:				
10619		University of California Davis Medical Center			S241013-34-00				
					Select with "X" or provide required OPAA information:				
Index #	Stage 1 Required (Select with "X")	Stage 2 Required (Select with "X")	Stage 3 Required (Select with "X")	ON-SITE SPECIAL INSPECTIONS	Samples of Test & Inspection Reports Included	OPAA No. and Expiration Date	Responsible Approved Agency And/Or Individual (Identify Special Inspector)	Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)
C-OT3	X	X	X	Exit Signs CBC 1013.1 Location, illumination and physical characteristics					
C-OT4	X	X	X	Accessible Signage CBC 11B-703.1 Visual and tactile requirements					

00004



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION D					NOTE: Approved agencies, individuals, and all changes to the TIO program shall be identified, evaluated by the DPOR and approved by HCAI prior to proceeding with the related work.				
Facility #:		Facility Name:			Project #:				
10619		University of California Davis Medical Center			S241013-34-00				
					Select with "X" or provide required OPAA information:				
Index #	Stage 1 Required (Select with "X")	Stage 2 Required (Select with "X")	Stage 3 Required (Select with "X")	Samples of Test & Inspection Reports Included	OPAA No. and Expiration Date	Responsible Approved Agency And/Or Individual (Identify Special Inspector)		Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)
OFF-SITE SPECIAL INSPECTIONS									



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION E		REQUIRED COMPLIANCE FORMS			
Facility #:	Facility Name:	Project #:			
10619	University of California Davis Medical Center	S241013-34-00			
Form #	Required (Select with "X")	DOCUMENT NAME	Responsible Designer Or Installing Contractor	Compliance Verification by IOR (Initial/Date)	HCAI/FDD Use (Initial/Date)



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION F		CONSTRUCTION VERIFICATION										
Facility #:	Facility Name:								Project #:			
10619	University of California Davis Medical Center								S241013-34-00			
VERIFIED CONSTRUCTION INSPECTION AND OBSERVATION REPORTING												
REFERENCE NUMBER	PROJECT STAGE(S), MILESTONE, OR INTERVAL (Clearly indicate which Stage(s) apply to which Milestone/Interval)	VERIFIED COMPLIANCE REPORT REQUIRED AS INDICATED (Form HCAI-OSH-123) (See "PERSONAL KNOWLEDGE" as defined in California Administrative Code, Section 7-151)										HCAI/FDD USE
		GEOR	AOR	SEOR	MEOR	EEOR	CONT	IOR	SP INSP	TEST LAB		
	Clear all plan review Outstanding Items List (OIL) Items											
1	Stage 1: Remodel of Non-sterile Compounding Room [0711A] and building of Staff Lounge [0779]		X	X	X	X	X	X				
2	Stage 2: Remodel of Narc Pharmacy [0762H] and Multi-User Toilet Rooms [0784 & 0786]		X	X	X	X	X	X				
3	Stage 3: Remodel of Offices [0711C & 0715A], remodel of Hallway [0715], and building of Office [0715B], Receiving Area [0776], & HD Drug Storage [0778]		X	X	X	X	X	X				
	Installation of Temporary Equipment											
	Removal of Temporary Equipment											
00044	Substantial Compliance (Remodel, Renovations, Maintenance projects, Equipment Replacement)											
	Certificate of Occupancy (New Buildings, Additions, Changes in Occupancy)											
	Construction Final											

ABBREVIATIONS:

GEOR - Geotechnical Engineer of Record
 MEOR - Mechanical Engineer of Record
 SP. INSP - Special Inspector

AOR - Architect of Record
 EEOR - Electrical Engineer of Record
 IOR - Inspector of Record

SEOR - Structural Engineer of Record
 CONT O/B - Contractor or Owner/Builder
 Test Lab – Engr. For the approved agency



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION G	Inspector of Record (IOR) Responsibility	
Facility #:	Facility Name:	Project #:
10619	University of California Davis Medical Center	S241013-34-00
INSPECTOR OF RECORD RESPONSIBILITIES. Per CAC 7-145: "The Inspector shall have personal knowledge, obtained by continuous inspection of all work of construction in all stages of its progress to ensure that the work is in accordance with the approved construction documents." This includes applicable Codes, Referenced Standards, Listings and Manufacturer's Installation Instructions applicable to the work shown in the approved construction documents. If a project has more than one inspector of record, the distribution of responsibilities for the work shall be clearly identified for each IOR per CAC 7-141(f). One IOR shall be designated as the 'lead' IOR per CAC 7-144(b). One IOR shall be assigned responsibility for "all other work" to make sure responsibility for the inspection of every part of the work is assigned.		
INSPECTOR OF RECORD CAC 7-141, 7-145 & 7-151	SCOPE OF INSPECTION	PERFORMED OFF-SITE
	All other work	



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION H		HCAI REVIEWED	
Facility #:	Facility Name:	Project #:	
10619	University of California Davis Medical Center	S241013-34-00	
NOTE: When a structural engineer has been delegated responsibility for a portion of this project his or her signature is also required.			
Submitted By:			
I have reviewed the approved construction documents for this project and all tests and special inspections required by Code are marked as "required" on this form.			
Ken Yamauchi			7/15/2024
Architect/Engineer of Record (Print Name)		Architect/Engineer of Record (Signature)	Date
Devon Lumbard			7/12/24
Structural Engineer of Record (Print Name)		Structural Engineer of Record (Signature)	Date
FOR HCAI USE			
TIO Program Reviewed by HCAI Plan Review Staff:			
Note: HCAI plan review staff must provide verification that the TIO program has been "Reviewed" prior to plan approval to confirm the applicability of the tests and inspections identified in the TIO program for work scope, building systems, and the construction materials shown in the design drawings. Field staff will issue subsequent "TIO Program Approval".			



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

SECTION I		TIO PROGRAM APPROVAL	
Facility #:	Facility Name:	Project #:	
10619	University of California Davis Medical Center	S241013-34-00	
This program is prepared and submitted for an OSHPD 1 project. OSHPD 1 projects include all construction and remodel projects for: general acute care hospitals, acute psychiatric hospitals, and general acute care hospitals providing only acute medical rehabilitation center services (2022 CBC 1224.1).			
Samples of Test and Inspection Reports are <i>NOT</i> required for tests performed by laboratories approved through OPAA Program			
<i>All test and special inspection reports shall be submitted to the IOR, hospital owner, architect in responsible charge, and the structural engineer by the responsible approved agency and/or individual per CAC 7-149(a). The responsible approved agency and/or individual shall be employed by the health facility, owner, or governing board or authority per CAC 7-149(b).</i>			
<i>Verified compliance reports shall be signed by the individual who performed the special inspection(s) as outlined in CAC 7-151 (c). All reports shall clearly state whether the tests or special inspections were performed in accordance with the HCAI stamped approved documents and whether the results indicate compliance with those documents per CAC 7-149 (a). All IORs performing special inspections shall hold the appropriate certification and equipment, and shall obtain approval from the design professional of record and HCAI prior to performing such work.</i>			
<i>NOTE: This Test, Inspection, and Observation Report shall be approved by HCAI field personnel prior to start of construction.</i>			
Ken Yamauchi	C-26566		7/15/2024
Architect/Engineer of Record (Print Name)	Professional License #	Architect/Engineer of Record (Signature)	Date
FOR HCAI FIELD STAFF USE			
TIO Program Approved by HCAI Field Staff:			
Note: HCAI plan review staff must provide verification that the TIO program has been "Reviewed" prior to plan approval to confirm the applicability of the tests and inspections identified in the TIO program for work scope, building systems, and the construction materials shown in the design drawings. HCAI Field staff will issue subsequent "TIO Program Approval".			
If "Approved with Comments" is checked the following comments shall be resolved by the designer prior to proceeding with the related construction:			



Testing, Inspection, and Observation Program

2022 California Building Standards Code - OSHPD 1

[illegible]

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. See Electrical Drawings for location of temporary power and source and spider box requirements. Contractor to complete RFS Work Book in Section 01 31 00 for power analysis of all tools requiring hardwire temporary power during each phase of the project. Please follow the Shutdown Procedures Section 01 31 00 including any prior notice and meeting attendance to review the power analysis forms with Plant Operations and Maintenance. All equipment cut sheets will be required for tools and construction equipment requiring temporary power for the review and approval of Plant Operations and Maintenance.
 3. Power Source: Arrange for service with University's Plant Operations and Maintenance Department, or local utility company. See #2 above for approval process.
 4. Conformance: All temporary wiring and electrical facilities shall be in accordance with applicable provisions of Electrical Safety Orders of the State of California.
 5. Temporary Lighting: Construction lighting shall be supplied and maintained by Contractor at its expense. Sufficient lighting levels shall be provided to allow construction to be properly and safely performed. Contractor shall give special attention to adequate lighting for stairs, ladders, floor openings, basements and similar spaces. Promptly replace burnt out, worn or defective parts.
 6. Lighting fixtures: Locate fixtures in areas of Work: One (1) lamped fixture in rooms, except closets and utility chases; one (1) lamped fixture for every 750 square feet in large areas.
 7. Security Lighting: Contractor shall provide security lighting during hours of low visibility.

B. Distribution requirements:

1. See permitted electrical drawings for temporary construction power source and requirements for disconnects, cabling and spider boxes by phase.
2. Wiring, connections and protection for temporary lighting.
3. Wiring connections and protection for temporary and permanent equipment, for environmental control, for temporary use of electricity operated equipment, and for testing.

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

1. It is expressly understood and agreed by Contractor that University existing power and lighting system's primary obligation is servicing patient care. The University system is not designed for purposes of construction activities.
2. Contractor should expect power and lighting interruptions during course of Work. Contractor will be required to cease use of University electrical-power and lighting systems, as required by the needs of University.
3. When use of University electrical system is approved in writing, Contractor is required to adhere to University's electrical lockout procedures. See Division 26—Electrical or Campus Design Guidelines.
 - a. Provide and maintain warning labels on energized equipment.
 - b. Replace plates, electrical devices or similar existing items or components damaged as a result of temporary usage.

1.05 TEMPORARY HEATING, COOLING AND VENTILATING

A. Service Requirements:

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

installed. Filters shall be cleaned and serviced by Contractor just prior to final acceptance.

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

B. Utility Sources:

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

1.06 TEMPORARY WATER

A. Service Requirements:

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

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

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

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

1.07 TEMPORARY FIRE PROTECTION

A. Requirements:

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

1.08 TEMPORARY TELEPHONE, DATA, INTERNET, and WIFI

A. Service Requirements:

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

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

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

1. **NOT USED**

PART II - PRODUCTS

2.01 MATERIALS

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

PART III - EXECUTION

3.01 INTERRUPTION OF EXISTING SERVICES

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

3.02 REMOVAL OF TEMPORARY CONSTRUCTION

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

END OF SECTION 01 51 00

SECTION 01 52 00
CONSTRUCTION FACILITIES

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

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

1.03 FIELD OFFICES AND SHEDS

- A. Field Office: NOT USED – Space will not be provided for a field office

1.04 TEMPORARY FACILITIES

- A. Contractor shall provide and maintain the following temporary facilities as required for execution of the Work:
 - 1. Scaffolding, staging, runways and similar equipment.
 - 2. Hoists or construction elevators, complete with operators, power and signals required.
 - 3. Temporary rigging, rubbish chutes, barricades around openings, ladders between floors, and similar equipment.
 - 4. Barricades, fencing, lights and similar safety precautions.
- B. Maintenance: Use all means necessary to maintain temporary construction facilities and controls in proper and safe condition throughout progress of the Work.
- C. Replacement: In event of loss or damage, promptly restore temporary construction facilities and controls by repair or replacement at no change to the Contract Sum or the Contract Time.

- D. Conformance: All materials and equipment required to safely accomplish work under this Section shall be in conformance with requirements of CAL OSHA and other State and Federal Codes and regulations where applicable.
- E. Codes: All temporary work and facilities shall conform to the above requirements that pertain to operation, safety and fire hazard.
- F. Construction Site Security: Temporary barriers, doors and gates shall be keyed to University's master lock system. Security hardware to be provided by Contractor. Keying to University master lock system will be provided by University.

1.05 TEMPORARY SANITARY FACILITIES

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

PART II - PRODUCTS

2.01 MATERIALS

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

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 52 00

SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

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

1.03 PARKING AREAS AND ACCESS ROADS

- A. Access Roads: Existing roads shall be used for construction access within limits defined herein. Temporary construction access roads shall not be permitted.
- B. Parking: Parking is controlled and limited by University.
 - 1. Parking of personal vehicles belonging to Contractor employees may be arranged with University's Parking Services, at 916-734-2687. Parking may be allowed in designated permit areas, at the current permit rates depending on space availability. There is no guarantee of available monthly permitted parking on campus even at the Contractor's expense.
 - 2. Delivery of materials may be made to the job-site as required. Contractor shall coordinate with University's Representative. Loading dock deliveries must be arranged with the University Representative at least two (2) weeks prior to delivery.
 - 3. Dumpsters shall not be located on campus. All discarded materials and trash shall be off hauled daily.
- C. Existing Pavements and Parking Areas: Designated existing on-site streets and driveways may be used for construction traffic. Vehicles with metal tracks will not be allowed.
 - 1. Designated areas of existing parking facilities may be used by construction personnel. Do not allow heavy vehicles or construction equipment in parking areas.

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

1.04 TRAFFIC REGULATION

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

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

1.05 PROJECT INFORMATIONAL SIGNS - NOT USED

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01 55 00

SECTION 01 56 00

TEMPORARY BARRIERS, ENCLOSURES and CONTROLS

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 5/8" thick Type-X rated gypsum wallboard fire taped, braced so to be self-supporting without fastening to existing finishes.
 - a. Provide gaskets of closed cell neoprene, or strips of fiberglass insulation between barriers and existing finish.

- b. Finish exposed surfaces with two (2) coats of paint (color as selected by University), maintain in neat, orderly appearance and paint barrier on public side. Temporary emergency exit and or directional signage indicating Emergency Exits will be furnished and installed by Contractor.
 - c. Provide temporary doors in corridors with twenty (20) minute fire-rated assemblies and locksets to limit use.
 - d. Use of access doors and routes by workmen to be approved by University's Representative.
 - e. See also project construction documents for construction of construction barriers.
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.
 - f. See also project construction documents for construction of construction barriers.

- 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. Use of polyethylene for critical barriers must be approved by the campus Fire Marshall. Construction of critical barriers must also comply with barriers indicated in the construction documents.

PART III - EXECUTION

3.01 Infection Control Risk Assessment ICRA Requirements (See also Section 01 56 10 Airborne Contaminants):

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

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

- 3.02 See Section 01 56 10 for updated documents (01/2023 Edition) to post at critical barriers and construction containments.

END OF SECTION 01 56 00

SECTION 01 56 10

AIRBORNE CONTAMINANTS CONTROL

PART I - GENERAL

1.01 SUMMARY

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

1.02 POLICY

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

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

F. Dust Mitigation Requirements

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

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

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

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

1.03 SUBMITTALS

- A. Submit to Project Inspector or Post at Anteroom Daily ICRA Inspection Log.
- B. Schedules: Submit work areas and procedure schedules for containment of airborne contaminants. Include this work in the Project Schedule per 013200.
- C. Detailed Work Plan: Drawings including but not limited to Work Area/ Floor Plan, Path of Travel, Egress and Exiting, Rated Construction and details of construction of necessary temporary barriers, and description of procedures to be used to achieve and maintain control of construction-related airborne contaminants.
 - 1. As applicable, the drawing should include the following: location of ante room(s), location of manometer, location of negative air units exhausting outside the construction area including number of negative air units and sizes (cfm), and location of sealed blocked off areas of corridors. If the exhaust of the negative air unit(s) cannot be exhausted outside of the building, the work plan shall include details, product documents and drawings of the approved fire-rated assemblies that will be used to meet Fire Codes (if applicable), Building Codes and ILSM requirements. Any impacts to corridors will need to be approved via ILSM (see specification section 013500 for details).
 - 2. Identify the areas surrounding the project area, assessing potential impact of construction on the patient care area. Identify the specific uses (e.g., patient rooms, medication room, operating room, etc.)
 - 3. Identify the potential impacts including but not limited to.
 - a. HVAC, Ventilation (outages, air flow directions, clean to dirty, air intakes/exhausts, air balance, disruptions, etc.).
 - b. Plumbing (outages, hand-washing access, work area, flushing/draining systems, charging systems, disinfecting systems, etc.).
 - c. Electricity (outages for critical equipment, special ventilation areas, monitoring). Also identify source of temporary power for any equipment required to provide all ICRA measures including containment, filtration and monitoring devices as identified on ICRA forms – see Section 015610 3.01 for Classifications.
 - 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 contractors' proposed foreman has successfully obtained one of the following from the American Society for Healthcare Engineering (ASHE):
 - a. Certified Healthcare Constructor (CHC) Certification
 - b. Health Care Construction (HCC) Certificate
 - c. Managing Infection Prevention During the Construction & Operation of Health Care Facilities Course Completion
 - d. Completion of an ICRA training course approved by University
 3. Documentation that all contractor employees and subcontractor's employees have successfully completed an ICRA training class that is approved by University. All personnel working with negative pressure containments shall be trained and knowledgeable in the following:
 - a. ICRA Permit contents and requirements
 - b. Site specific containment plan requirements that follow best management practices
 - c. Infection risks associated with construction
 - d. Methods to control the dissemination of dust and fungal spores
 - e. Proper use of protective clothing
 - f. Proper entry and exit procedures
 - g. Manufacturer's requirements, where manufactured containment systems are used (e.g., portable pop-up cubes)
 - h. How to respond to a loss of negative pressure or too much negative

pressure

- i. Breach in practice response and required notifications

4. Contractors shall be additionally trained in the following:

- a. Proper containment design, construction, and maintenance techniques
- b. Proper load out techniques for equipment/wastes
- c. Containment cleaning regime: daily, final, and terminal cleaning

5. Containment failure emergencies caused by the contractor may require retraining at the discretion of the University's Representative Infection Control, or Environmental Health & Safety. Training is to be provided by University Environmental Health & Safety or a University approved training consultant.

6.

1.04 QUALITY CONTROL

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

1.05 DEFINITIONS

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

larger. DOP testing is performed by specialty contractors. The Health System requires that HEPA systems be tested to the ANSI / ASTM standard as delivered prior to their use onsite as further described in this Standard.

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

1.06 PERFORMANCE REQUIREMENTS

A. University's Representative's Responsibilities:

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

B. Contractor Responsibilities:

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

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

PART II - PRODUCTS

2.01 MATERIALS

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

PART III - EXECUTION

3.01 PROJECT SPECIFIC REQUIREMENTS:

- A. The below criteria shall be applied on a case-by-case basis as outlined in the project specific requirements, ICRA Permit(s), and EH&S Worksheet(s)

ICRA Permit will be obtained once Contractor Notice to Proceed is issued. For bidding purposes:

- a. Assume all containments will be Class V with the exception of Women and Men's Multi-User Staff Toilet Rooms. See attached ICRA form at the end of this specification section for Class V requirements. Both rated and unrated construction barriers are indicated on the contract documents. See Architectural Drawings.
- b. Assume containments will be Class III at the Women and Men's Multi-User Toilet Rooms only. See attached ICRA form at the end of this specification section for Class III requirements. Both rated and unrated construction barriers are indicated on the contract documents. See Architectural Drawings.

3.02 CONTAINMENT CRITERIA

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

- B. The interior of the containment area shall be cleaned on a continual basis daily. Hard surface floors in work area, adjacent hallways and passage areas require vacuuming with HEPA-filtered vacuum cleaners and frequent wet-mopping during demolition and construction; protect adjacent carpeted areas with plastic and plywood and vacuum with HEPA-filtered vacuum cleaners. Only an EPA Listed Germicide approved by the UC Davis Health Infection Prevention shall be used on the project site.
- C. Contractor shall inspect the containment daily prior to starting work and immediately repair any breaches, holes, or other issues.
- D. For projects of extended length when work activity is not being performed, including on weekend or holiday periods, and if the work area had a very thorough surface cleaning and received a passing visual inspection by a third party environmental consultant, the daily inspections are not required. At a minimum, ICRA inspections shall be made weekly for containments on projects of extended non-work activity.
- E. Regardless of containment strategies, execute work by methods to minimize raising dust from construction operations. Water may be used to assist in controlling airborne dust.
- F. Full containment
 - 1. All surfaces in the containment area except surface where work is to occur must be covered in plastic unless they are non-porous, smooth, and accessible for cleaning.
 - 2. Sealing of Openings: Use fire-rated tape or other impenetrable sealant to seal barrier wall seams, cracks around window and door frames, exhaust system ductwork, pipes, joints and ducts. Use of spray glue is not acceptable to be used inside of the building.
 - 3. Contractor must block off existing ventilation supply registers, return registers and exhaust registers in the construction area as critical barriers. Materials used to block off these critical barriers in a temporary construction area not exceeding 30 days may be constructed of 6-mil fire-rated plastic. Materials used to block off these critical barriers in a construction area exceeding 30 days shall be constructed of an approved fire-resistive material other than 6 mil plastic.
 - 4. All polyethylene (plastic) and other materials used for temporary enclosures shall be at least 6 mil thickness and fire-retardant type. Zip poles or other easily removable supports shall be used for projects extending beyond one work shift. Temporary walls with metal stud framing may be required for long term projects and must be approved by the Project Manager. All doors leading into the containment area shall utilize zippered doors for control of the air flow and closing the plastic doors. Flapped doorways consisting of overlapping plastic are not acceptable in the building.
 - 5. Creation of the negative pressure enclosure includes the requirement to complete temporary barrier walls in the attic space from the top of the ceiling to the underside of the roof deck in the project area when the ceiling system is opened.
 - 6. Creation of negative pressure enclosure includes sealing wall cavities that are opened to prevent air transmission between adjacent spaces and the attic space that has air pathway to the attic space.
 - 7. For temporary construction projects that do not exceed 30 calendar days,

temporary work area containments may be constructed of 6-mil fire-rated polyethylene unless otherwise shown on the contract drawings as a specified barrier construction or type. Approval for 6-mil fire-rated polyethylene barrier shall be by the Fire Marshal.

8. For projects that exceed 30 calendar days, all barriers used to construct the temporary containment systems in the project area shall be hard barriers that meet the ASTM E84, Class A requirements for smoke and fire. This will include the use of a hard door integral to the temporary containment system to allow access and egress to and from the construction area.
9. Smoke detectors that are present inside of the construction work area can be temporarily covered during the work shift with a loose-fitting plastic "shower cap" that is commonly used on projects to prevent smoke alarms from inadvertently being triggered from dust. If this temporary dust control measure is used, the plastic overs shall be removed at the end of each work shift.

G. Critical seal of areas

1. Use tape or other impenetrable sealant to seal barrier wall seams, cracks around window and door frames, exhaust system ductwork, pipes, joints and ducts. Use of spray glue is not acceptable to be used inside of the building.

H. Double Ante Rooms with Negative Air Unit Attached to One Ante Room

1. In some locations when the negative air exhaust cannot be directed outside the building, and while temporary barriers are being installed, use of two anterooms connected in series to the construction zone may be used temporarily until full negative pressure containment is achieved. The use of double anterooms is a temporary measure and shall not be considered a primary means of negative pressure for control of dust. It must receive approval by Infection Prevention or EH&S before it can be considered. The configuration includes two anterooms connected with the clean anteroom accessible from the corridor, room, or space to access the project area. The second anteroom is connected to the construction work area.
2. If approved, a HEPA filtered negative air unit shall be attached to the anteroom that is connected directly to the construction work area. This anteroom is considered the "dirty" anteroom because air is drawn into this room from the construction area. The first anteroom accessible from the corridor, room or space is considered a "clean" anteroom because air is unidirectional, moving into the second anteroom.

I. Cubes

1. Mini-containments (pop-up cubes) which are designed to have at most 1-2 people are means of control to access attic spaces, wall spaces and subfloor spaces usually at defined entry points such as access hatches or above a drop-in ceiling system. Cubes shall have a HEPA filtered negative air unit attached or integral to the cube to create a negative pressure work environment inside of the cube. Cubes are reviewed and approved by the University's Representative on a case by case basis.

J. Glove Boxes

1. A glove box can be used for some work where a HEPA filtered vacuum is attached to the glove box when a small area of work is to be performed. A glove bag is attached to the box enclosure to allow the worker to make small openings by drilling or cutting within the negative pressure glove box. Glove boxes are reviewed and approved by the University's Representative on a case by case basis.
- K. Shrouded tools
1. Shrouded tools can be used for some work. A HEPA (DOP Tested) filtered vacuum is attached to the shroud. Shrouded tools are reviewed and approved by the University's Representative on a case by case basis.

3.03 NEGATIVE AIR CRITERIA

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

filter change, when dropped or damaged or moved from the project site. Only HEPA systems that pass the challenge DOP testing can be used on the project. All HEPA equipment shall be tested per ANSI/ASME N510 Section 10 to ensure 99.97% efficiency at 0.3 micrometer mean aerodynamic diameter.

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

3.04 NEGATIVE AIR MONITORING CRITERIA

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

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

B. Hybrid Monitoring and Visual Verification

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

3. At the end of shift all openings must be sealed to bring the containment back to the -0.020 in-WC requirement.

3.05 ADDITIONAL CONTAINMENT CRITERIA

A. Ante Room

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

B. Air Scrubbing

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

C. Disposable Coveralls and Booties

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

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

3.06 CONTAINMENT SET UP

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

3.07 REMOVAL OF CONTAINMENT

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

thoroughly cleaned the entire containment area. The Contractor will be allowed to remove the containment barriers after the interior has passed the visual inspection for cleanliness.

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

3.08 ENTRY/EGRESS

- A. Entry into the project containment area shall be through the ante room. Entry into the ante room requires one of the two zippered doors to be opened at one time to maintain the required negative pressure. After entering the ante room, the zipper shall be closed before leaving the ante room into the containment area. Equipment and supplies brought into the containment area shall be in sealed leak tight containers inside of rolling covered carts. Equipment, tools and supplies brought into the building shall be clean and free of dust, debris, mold and other contaminants. Cardboard products shall not be brought into the containment area if they are water damaged or have suspect mold growth.
- B. All HEPA equipment when transported into and out of the containment area shall be cleaned of all debris on the surfaces and shall have the intake openings sealed with plastic and duct tape.
- C. All workers leaving the containment area shall leave in clean clothes. At no time shall disposable coveralls or booties be worn when leaving the containment area through the anteroom into the public area. The workers shall clean all gross particulate debris from the coveralls using a HEPA filtered vacuum. Disposable coveralls can be taken off after gross debris has been removed from the disposable coveralls. The worker shall remove the disposable coverall inside of the 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.

3.09 ENFORCEMENT

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

3.10 Refer to the following Attachments

- A. Infection Control Risk Assessment (ICRA) with Matrix of Precautions for Construction & Renovation: 17 Pages.
- B. Infection Control Construction Permit: 1 Page (Page 8 or 17 completed).
- C. UCDH Construction Dust & Hazardous Materials Inspection Worksheet: 2 Pages.
- D. ICRA Permit Extension Request and Instructions: Available Upon Request – new date on same forms.
- E. 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.
 - 3. Appendix C: Staff Education Poster.

END OF SECTION 01 56 10

INFECTION CONTROL RISK ASSESSMENT

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

BASIC PROJECT INFORMATION			
Project Name:	Project Number:	Today's Date	
Impacted Department(s):	Building Number and Name:	Floor:	Suite/Room:
Estimated Construction Start Date:		Estimated Completion Date:	
UCDH Project Manager:	UCDH PM Mobile Phone #:	UCDH PM Email:	
Construction Manager:	CM Mobile Phone:	CM Mobile Email:	
GENERAL PROJECT SCOPE			
ATTACH DESCRIPTIVE PROJECT SCHEMATIC OR IMAGE TO PACKET			
MULTIDISCIPLINARY TEAM			
Identify the multidisciplinary team included in this review and agree with the requirements identified within the package.			
Department	Name	Email	
UCDH Project Manager			
Fire Marshal's Office			
Infection Prevention			
Environmental Health & Safety			
Contractor Representative			
Other Multidisciplinary Team Members			

INFECTION CONTROL RISK ASSESSMENT

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

Type A ☐	Inspection and non-invasive activities. Includes but is not limited to: • Removal of ceiling tile for visual inspection-limited to 1 tile per 50 square feet with limited exposure time. • Limited building system maintenance (e.g., pneumatic tube station, HVAC system, fire suppression system, electrical and carpentry work to include painting without sanding) that does not create dust or debris. • Clean plumbing activity limited in nature.
Type B ☐	Small-scale, short duration activities that create minimal dust and debris. Includes but is not limited to: • Work conducted above the ceiling (e.g., prolonged inspection or repair of firewalls and barriers, installation of conduit and/or cabling, and access to mechanical and/or electrical chase spaces). • Fan shutdown/startup. • Installation of electrical devices or new flooring that produces minimal dust and debris. • The removal of drywall where minimal dust and debris is created. • Controlled sanding activities (e.g., wet, or dry sanding) that produce minimal dust and debris.
Type C ☐	Large-scale, longer duration activities that create a moderate amount of dust and debris. Includes but is not limited to: • Removal of preexisting floor covering, walls, casework, or other building components. • New drywall placement. • Renovation work in a single room. • Nonexistent cable pathway or invasive electrical work above ceilings. • The removal of drywall where a moderate amount of dust and debris is created. • Dry sanding where a moderate amount of dust and debris is created. • Work creating significant vibration and/or noise. • Any activity that cannot be completed in a single work shift.
Type D ☐	Major demolition and construction activities. Includes but is not limited to: • Removal or replacement of building system component(s). • Removal/installation of drywall partitions. • Invasive large-scale new building construction. • Renovation work in two or more rooms.
Type E ☐	Exterior Construction typical activities. include, but are not limited to: • Excavation, Trenching, Grading, Boring, Pile Driving, Demolition • Asphalt, Concrete, Stucco, Scaffolding • Roofing • Window washing, Caulking, Tuckpointing, Cleaning, Painting • Landscaping, Planting
Explain the reasoning for this assessment:	

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

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

Describe key patient risks:

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

	Construction Project Activity Type				
Patient Risk Group	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E
LOW Risk	☐ I	☐ II	☐ II	☐ III*	☐ Exterior
MEDIUM Risk	☐ I	☐ II	☐ III*	☐ IV	
HIGH Risk	☐ I	☐ III	☐ IV	☐ V	
HIGHEST Risk	☐ III	☐ IV	☐ V	☐ V	

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

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

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

Surrounding Area Assessment

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

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

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

NOISE AND VIBRATION ASSESSMENT

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

AIR QUALITY IMPACT

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

HAZARDOUS MATERIALS

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

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

ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS

Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)?		☐ Yes	☐ No
How was this verified?	☐ Hazmat Survey	☐ Personal Knowledge	
	☐ Other:		
Who verified this information?	☐ Company:		
	☐ Person and Department:		
	☐ Other:		
Hazardous Materials Present in Project Work Area	Required Control Measures		
☐ Asbestos ☐ Lead ☐ PCBs ☐ Universal Waste ☐ Other:	Follow work practices outlined in the General Requirements Division 1 Document.		

CONTAINMENT REQUIREMENTS WORKSHEET

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

ICRA Permit Number	ICRA Class
23-	NP

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

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

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

INFECTION PREVENTION REQUIREMENTS - CLASS I

Prior to and During Construction:	• Perform non-invasive work activities not to block or interrupt patient care. • Perform non-invasive work activities in areas that are not directly occupied by patients. • Perform non-invasive work activity in a manner that does not create dust. • Immediately replace any displaced ceiling tile before leaving the area and/or at the end of non-invasive work activity.
Upon Completion of Work:	Cleaning • Clean work areas, including all environmental surfaces, high horizontal surfaces, and flooring materials. • Check all supply and return air registers for dust accumulation on upper surfaces and air diffuser surfaces. HVAC Systems • Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. • Verify the HVAC systems meet original airflow and air exchange design specifications.
	Additional Infection Prevention Requirements:

INFECTION PREVENTION REQUIREMENTS - CLASS II

Prior to and During Construction:	• Perform only limited dust work and/or activities designed for basic facilities and engineering work. • Perform limited dust and invasive work following standing precautions procedures approved by the organization. • This Class of Precautions must never be used for construction or renovation activities.
Upon Completion of Work:	Cleaning: • Clean work areas, including all environmental surfaces, high horizontal surfaces, and flooring materials. • Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. HVAC Systems: • Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. • Verify the HVAC systems meet original airflow and air exchange design specifications.
	Additional Infection Prevention Requirements:

INFECTION PREVENTION REQUIREMENTS - CLASS III

Prior to and During Construction:	• Provide active means to prevent airborne dust dispersion into the occupied areas. • Means for controlling minimal dust dispersion may include hand-held HEPA vacuum devices, polyethylene plastic containment, or isolation of work area by closing room door. • Remove or isolate return air diffusers to avoid dust from entering the HVAC system. • Remove or isolate the supply air diffusers to avoid positive pressurization of the space, • If work area is contained, then it must be neutrally to negatively pressurized at all times. *If negative pressure is required, see additional requirements below. • Seal all doors with tape that will not leave residue • Contain all trash and debris in the work area. • Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. • Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. • Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces. Additional requirements for Class III containments that require negative pressure: • Maintain negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows requires the highest degree of filtration feasible. • If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, HEPA filtration must be verified by particulate measurement as no less than 99.97% efficiency and must not alter or change airflow/pressure relationships in other areas. • Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable. • Install digital monitoring manometer with one thousandth of inch of water pressure (eg. - 0.024) exterior of work containment to continually monitor negative pressurization. The non-digital manometer monitors are not acceptable.
Upon Completion of Work:	Cleaning: • Clean work areas including all environmental surfaces, high horizontal surfaces, and flooring materials. • Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. HVAC Systems: • Remove isolation of the HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. • Verify the HVAC systems meet original airflow and air exchange design specifications. Class III precautions require inspection and documentation for downgraded ICRA precautions. Construction areas must be inspected by the designee on the containment requirements worksheet for discontinuation or downgrading of ICRA precautions. Work Area Cleaning: • Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials.

INFECTION PREVENTION REQUIREMENTS - CLASS III

- Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces.

Removal of Critical Barriers:

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

Negative Air Requirements:

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

HVAC systems:

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

Additional Infection Prevention Requirements:

INFECTION PREVENTION REQUIREMENTS - CLASS IV

Prior to and During Construction:

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

INFECTION PREVENTION REQUIREMENTS - CLASS IV

Upon Completion of Work:

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

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

Work Area Cleaning:

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

Removal of Critical Barriers:

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

Negative Air Requirements:

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

HVAC systems:

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

Additional Infection Prevention Requirements:

INFECTION PREVENTION REQUIREMENTS - CLASS V

Prior to and During Construction:

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

INFECTION PREVENTION REQUIREMENTS - CLASS V

Upon Completion of Work:

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

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

Work Area Cleaning:

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

Removal of Critical Barriers:

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

Negative Air Requirements:

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

HVAC systems:

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

Additional Infection Prevention Requirements:

INFECTION PREVENTION REQUIREMENTS – EXTERIOR

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

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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 contractors' 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
- Containment 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.

Bartley, J. APIC State-of-the-Art Report: The role of infection control during construction in health care facilities. American Journal of Infection Control, 28(2):156–69.

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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.

Caution

Construction Dust Precautions In Use Do Not Enter

For More Information Contact the UCDH Project
Manager

(Name)

Phone Number

This sign must be posted in color



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HAZARDOUS MATERIALS SURVEY FINAL REPORT

OWNER/CLIENT

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CONTACT

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BUILDING SURVEYED

Davis Tower – Lower Level Pharmacy Renovation Project

PREPARED BY

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Entek Project #24-7086

April 22, 2024

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Appendices

- A. Asbestos Related Documents
- B. Lead Related Documents
- C. Backup Documents

Executive Summary

Entek Consulting Group, Inc. (Entek) is pleased to provide Mr. Aaron Allen, Project Manager with the UC Davis Medical Center Facilities, Planning, and Development Capital Projects with this hazardous materials report regarding the Davis Tower Lower Level Pharmacy Renovation Project located at 2315 Stockton Boulevard in Sacramento, California.

The purpose of the inspection was to comply with US EPA NESHAP requirements and the Sacramento Metropolitan Air Quality Management District (SMAQMD) which has jurisdiction for this project site to determine if asbestos containing materials are present which may be impacted during the upcoming Davis Tower Lower Level Pharmacy Renovation Project. It is Entek's understanding that the upcoming project will include demolition of select wall systems, mechanical and electrical, the installation of new flooring, installation of additional plumbing, attachment above ceiling, and acoustical ceiling adjustments and rework.

The United States Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants (US EPA NESHAP), 40 CFR Part 61 - Nov. 20, 1990, requires an owner or operator of a demolition or renovation project to thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos-containing materials (ACM) prior to the commencement of that project.

The attached drawing show approximate sample locations and also identify those bulk sample materials analyzed and found to contain asbestos greater than 1% with a (+) after the sample number. Materials analyzed and found to contain less than 1% asbestos or reported as none detected have a (-) after each sample number.

Contractors and other individuals who view the sample locations and associated results indicated with either a (-) or a (+) on the drawing to make determinations take the risk of misidentifying a material and may arrive at determinations which are in direct conflict with the written findings of this report. This use of the drawing and the information provided on it relating to individual sample results in determining if a material does or does not contain asbestos is not recommended.

This is a summary of the report. The report must be read in its entirety, and the reader must review all the detailed information provided in the body of the report prior to making any interpretations, or conclusions pertaining to the information. Any conclusions made by the reader about the information provided in the body of this report which are contradictory or not included in this report are the responsibility of the reader.

Asbestos

On February 22, 2024, Entek conducted a survey specific to areas designated by Ms. Jill Davis, Project Executive with Rudolph & Sletten (R&S) on behalf of the UC Davis Medical Center (UCDMC). The survey included Corridor 0715, Corridor 0760B, Equipment Storage/Issue 0761, and Office 0711C, Unit Dose 0711/0711A, Central Pharmacy 0762, Admin Office 0762, Womens Restroom 0786 and Mens Restroom 0784. No other areas

were included within this survey.

None of the suspect materials collected are determined to contain asbestos. Specifics pertaining to individual materials are found in later parts of this report.

Lead

Entek investigated existing paints in an effort to determine if lead was present in these materials.

The beige paint on drywall throughout was determined to contain lead below the laboratory limit of 100 parts per million (ppm).

Other Hazardous Materials

Entek did not specifically inspect for mercury containing fluorescent light tubes or light ballast which may contain polychlorinated biphenyls (PCBs), thermostats which may contain mercury switches, equipment or systems which may contain Freon or other fluorocarbons, or smoke detectors which may contain a radioactive element. However, information pertaining to these materials is included in this report for your use and reference, since these light systems are present on the project.

Introduction

This report presents results of an asbestos and lead survey performed by Entek which included interior areas of the Lower Level of Davis Tower located at 2315 Stockton Boulevard in Sacramento, California. These areas were designated by Ms. Jill Davis, Project Executive with R&S on behalf of the UCDMC. Fluorescent lights were observed at this project site; therefore, this report also includes references to regulations pertaining to handling practices and waste disposal of PCB light ballasts and mercury containing light tubes which may be impacted during this project.

The inspection was conducted by Karl Suarez on February 22, 2024. Mr. Suarez is a Cal/OSHA Certified Asbestos Consultant (CAC) and a State of California Department of Public Health (CDPH) certified Lead Inspector/Assessor.

This report was prepared for Mr. Aaron Allen, Project Manager with the UC Davis Medical Center Facilities, Planning & Development (UCDMC FP&D).

Building Description

Davis Tower within the UC Davis Medical Center is a multi-story metal framed building with a concrete foundation. Interior finishes within Corridor 0715, Corridor 0760B, Equipment Storage/Issue 0761, Office 0711C, Unit Dose 0711/0711A, Central Pharmacy 0762, Admin Office 0762, and Womens Restroom 0786 and Mens Restroom 0784 included vinyl floor tile, rolled carpeting, vinyl base cove, drywall wall systems, and drop-in acoustical ceiling panels. The above ceiling plenum consists of fiberglass insulated HVAC ducts and plumbing, sprayed-on fireproofing in select areas on the metal structural beams and the metal ceiling deck, and unfinished drywall wall systems towards the ceiling

deck. No other interior or exterior areas of the UC Davis Medical Center were surveyed.

Asbestos Inspection and Sample Collection Protocols

Entek included all interior materials that are expected to be impacted by the upcoming Davis Tower Lower Level Renovation Project included in this report.

Entek did not use any demolition methods to look within enclosed wall or ceiling cavities during this investigation. Entek did include all suspect materials observed in, on, or associated with the areas included in this report.

Entek reviewed existing records pertaining to previous bulk sampling reports to determine if adequate sampling of some or all existing suspect materials had already been performed.

Bulk samples were collected of various materials suspected to contain asbestos by utilizing a power drill and coring tube, cutting the materials with a razor knife, or use of other appropriate hand tools.

Miscellaneous materials were collected from each homogenous area in a manner sufficient to determine whether the material is or is not ACM as required in 40 CFR Part 763, Asbestos-Containing Materials in Schools; Final Rule and Notice, published October 30, 1987.

Approximate locations of all samples collected during this inspection are indicated on the "Bulk Asbestos Material Analysis Request Form for Entek", which served as the chain of custody for the samples, and on the building diagram attached to this report.

Asbestos Bulk Sample Results

There were several materials observed which are considered "suspect" under US EPA guidelines. Under current US EPA guidelines for conducting building inspections for ACM, all "suspect" materials must be assumed to contain asbestos until otherwise determined by laboratory testing.

The samples of materials suspected of containing asbestos were submitted to Asbestech Laboratory, which is a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory to complete this analysis. These samples were subsequently analyzed by polarized light microscopy (PLM) with dispersion staining by the EPA 600R/R-93/116 method.

The US EPA NESHAP and SMAQMD uses the terms Regulated Asbestos Containing Material (RACM), Category I, and Category II when identifying materials which contain asbestos in amounts greater than 1%. Cal/OSHA uses the term ACCM which indicates a manufactured construction material contains greater than 0.1% asbestos by weight by the PLM method. This definition can be found in Title 8, 1529.

A total of 35 bulk samples were collected of all "suspect" materials that were observed during this investigation. Some of those samples contained multiple layers which were

individually analyzed to determine their asbestos content. their asbestos content. Analysis of all samples collected was by PLM with dispersion staining. Results of the analysis are listed in the following table:

Suspect Materials Found NOT TO Contain Asbestos Davis Tower Pharmacy Lower Level Renovation Project				
Sample ID#’s	Suspect Material	EPA AHERA “Suspected” ACBM	Asbestos Content	Location
01A-G	Blue-Gray Sprayed-On Fireproofing	Surfacing Material	None Detected	Above Ceiling on Metal Fluted Deck and Metal I-Beams?Throughout
02A-B	Red Fire Caulking	Miscellaneous Material	None Detected	Pipe Penetrations Throughout
03A-B	Green Fire Caulking	Miscellaneous Material	None Detected	Pipe Penetrations Throughout
04A-B	Gray HVAC Seam Sealant	Miscellaneous Material	None Detected	Above Ceiling, on HVAC Duct Throughout
05A-B	Tan Fire Sprinkler Thread Sealant	Miscellaneous Material	None Detected	Above Ceiling on Sprinkler Piping Throughout
06A-D	Drywall and Joint Compound	Miscellaneous Material	None Detected	Wall Systems Throughout
07A-B	2’ x 4’ Drop-In Acoustical Ceiling Tile	Miscellaneous Material	None Detected	Ceiling Throughout
08A-B	4” Black Vinyl Cove Base with Tan Mastic	Miscellaneous Material	None Detected	Base of Drywall Wall Systems Throughout
09A-B	4” Tan Vinyl Cove Base with Tan Mastic	Miscellaneous Material	None Detected	Base of Drywall Wall Systems Throughout
10A-B	Multicolor Carpet with Yellow Mastic	Miscellaneous Material	None Detected	Flooring Throughout
11A-B	12” x 12” White and Gray Vinyl Floor Tile with Yellow Mastic	Miscellaneous Material	None Detected	Flooring Throughout
12A-B	12” x 12” Gray Vinyl Floor Tile with Clear Mastic	Miscellaneous Material	None Detected	Flooring Throughout
13A-B	2” x 2” White Ceramic Floor Tile with White Grout	Miscellaneous Material	None Detected	Restrooms 0784, 0786

All sample numbers noted in the tables above start with ECG-24-7086-

None of the materials sampled were determined to contain asbestos. Specifics pertaining to the materials sampled and the sample locations can be referenced in Appendix A.

US EPA AHERA uses three terms when determining the classification of a material for the purpose of sampling. These terms include miscellaneous, surfacing, and thermal system insulation (TSI).

Miscellaneous materials are building materials on structural components, structural members or fixtures, such as floor and ceiling tiles, and do not include surfacing material or TSI.

Surfacing materials are materials that are sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceiling and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

TSI is material applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain, water condensation, or for other purposes.

The information provided in the tables of this report are for use by the Owner in determining where asbestos containing materials are located, and whether or not any future work may impact those materials. The information is also provided for use by any contractor who may perform work in areas impacting the materials listed in this report, and for use as appropriate by asbestos abatement contractors to provide costs related to work impacting ACM.

Any building materials which are considered “suspect” for containing asbestos which have not been identified in this report must be assumed to contain asbestos in amounts >1% until properly investigated and/or tested.

Materials commonly excluded from being suspected for containing asbestos include, but are not limited to: unwrapped pink and yellow fiberglass insulating materials or products, foam insulation, wood, metal, plastic, or glass. All other types of building materials or coatings on the materials listed above are commonly listed as “suspect” and must be tested prior to impact by a Contractor. Work impacting these untested or newly discovered materials must cease until an investigation can be completed.

Asbestos Regulatory Requirements

US EPA

The property included in this survey report is located in Sacramento County. Sacramento Metropolitan Air Quality Management District (SMAQMD) has been given authority for enforcement of the NESHAP regulations by means of their own rules (Rule 902 Asbestos).

A demolition is the wrecking, taking out, or burning of any load supporting structural member. A renovation is everything else. 10 day written notification to the US EPA Region IX, CARB or local AQMD is required prior to the performance of any demolition project regardless of asbestos being present or not. This notification would also apply to any renovation project which involves the wrecking, taking out, or burning of any load bearing structural member during a renovation as well.

Since none of the materials sampled were determined to contain asbestos, a 10 day notification to the SMAQMD is not required to be submitted prior to starting work for asbestos reasons.

Cal/OSHA

Disturbance of any ACM or ACCM could generate airborne asbestos fibers and would be regulated by Cal/OSHA. Cal/OSHA worker health and safety regulations apply during any disturbance of ACM or ACCM by a person while in the employ of another. This is true regardless of friability or quantity disturbed.

Since none of the materials anticipated to be impacted as part of this project were determined to contain asbestos, a licensed asbestos contractor, certified by the State of California, and registered with Cal/OSHA is not required to perform the demolition/renovation work.

Lead Sampling Results

One bulk sample of the painted surfaces expected to be impacted in the Davis Tower Lower Level Renovation Project was collected and submitted to MicroTest Laboratories, Inc. (MicroTest) located in Rancho Cordova, California. The bulk sample (paint chip) was analyzed utilizing the NIOSH 7082 method (including the EPA 7000B and EPA 7420 methods) utilizing flame atomic absorption spectroscopy. MicroTest is accredited by the Environmental Laboratory Accreditation Program (ELAP) to perform the analysis. Results of the analysis are listed in the following table and further details are in Appendix B.

Paints Determined NOT TO Contain Lead	
Davis Tower Lower Level Renovation Project	
Paint/Coating Color or Material	Building Component
Beige Paint	Drywall Wall Systems / Throughout Corridors, Rooms, and Restrooms

Paints determined “NOT TO” contain lead for the purposes of this report are those samples which when analyzed did not indicate lead to be present at or above the limit of detection for the analysis method used. This limit of detection was 50 parts per million (ppm). As a result, any paints shown “NOT TO” contain lead will not require any special training or work practices related to lead when impacted.

Lead Regulatory Compliance

Any upcoming project which may result in the disturbance of lead containing products or surfaces, but is not intended to remediate a lead hazard or specifically designed to remove LBP to reduce or eliminate a known hazard, would be considered “lead related construction work”.

Since no detectable amount of lead was found, Cal OSHA regulations found in 8 CCR 1532.1 Lead in Construction will not apply to this project.

Fluorescent Light Tubes and Polychlorinated Biphenyls (PCBs)

Fluorescent light tubes which contain mercury are considered a universal waste and must be packaged and recycled appropriately if they are removed from a building and not used again. The regulation, called the Universal Waste Rule, are in the California Code of Regulations (CCR), Title 22, Division 4.5, Chapter 23.

Fluorescent light tubes are the bulb or tube portion of an electric lighting device and are commonly referred to as "lamps". Examples of other common electric lamps considered to be universal wastes include, but are not limited to, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps. Any lamp which is not spent and has been designated to be reused is not classified as a waste and does not meet the requirements of a hazardous waste or a universal waste.

Spent lamps typically contain concentrations of mercury exceeding the established Total Threshold Limit Concentration (TTLC) and/or the Soluble Threshold Limit Concentration (STLC) values. Therefore, these lamps must be sent to an authorized recycle facility or to a universal waste consolidator for shipment to an authorized recycling facility.

At a minimum, if removed lamps will not be reused they must be packaged in boxes/packages/containers which are structurally sound, adequate to prevent breakage, and compatible with the content of the lamps. These packages must remain closed and be free of damage which could cause leakage under reasonably foreseeable conditions. Each container must be labeled or marked clearly with one of the following phrases: "Universal Waste Lamp(s)," or "Waste Lamp(s)," or "Used Lamp(s)." Entek recommends shipping any lamp not designated for reuse to a universal waste recycling facility once they have been packaged.

PCB containing light ballasts are to be considered a hazardous waste, and must be properly manifested for transport to a hazardous waste facility. Any contractor who may perform PCB related work (inspection, removal, clean-up) must be trained and qualified to do so. All workers must also follow current OSHA regulations including 29 CFR 1910.120 and 8 CCR 5192, as well as, other applicable federal, state, and local laws, and regulations. While light ballasts marked "No PCB" are not considered a hazardous waste, they are considered a universal waste. As a result, removal, packaging, and disposal/recycling of these types of ballasts must be conducted in accordance with current regulations of Title 22.

Limitations

Entek inspected only the specific designated areas as identified by Ms. Jill Davis, with R&S on behalf of UCDCM in preparation to the Davis Tower Pharmacy Lower Level Renovation Project. This survey does not include the other surrounding areas in UCDCM. Therefore, the information provided in this inspection report may not be used to extend the inspection results to areas not included in this report without additional review and sampling as necessary.

Entek did not perform any destructive sampling to look into ceiling and wall cavities. As a result, it may be possible for materials to be hidden in these areas which are not included

in this report. Entek also did not employ any destructive measures on floors of interior spaces or exterior areas covered with asphalt, concrete, or dirt.

If any new materials not listed as having been sampled, or listed as assumed for containing asbestos in this report are discovered, the new material must be assumed to contain asbestos until properly inspected and tested for asbestos content.

Entek's policy is to retain a full copy of these written documents for three years once the file is closed. At the end of the three year period the written files will be destroyed without further notice. It is suggested copies of the file(s) are maintained as per your policy.

Entek will be providing only this electronic copy of the report and its attachments for your use. However, if you would like a hard copy of this report please do not hesitate to ask. Entek will be happy to mail the report upon receipt of your request.

Thank you for choosing Entek for your environmental needs. Please call me at (916) 632-6800 if you have any questions regarding this report.

Prepared By:



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Project Manager
Cal/OSHA CAC # 23-7390
CDPH I/A # 11068

Reviewed By:



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Cal/OSHA CAC # 13-5015
CDPH I/A # 3315

Appendices

- A. Asbestos Related Documents
- B. Lead Related Documents
- C. Backup Documents

APPENDIX A

ASBESTOS RELATED DOCUMENTS

- Bulk Asbestos Analysis Report From Asbestech
- Bulk Asbestos Material Analysis Request Form for Entek
- Asbestos Bulk Sample Location Drawing
- SMAQMD Asbestos Survey Form
- SMAQMD Demolition/Renovation Form
(To be completed by Owner)

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Entek Consulting Group, Inc.
4200 Rocklin Rd., Suite 7
Rocklin, CA 95677

Job:

24-7086 UCDMC FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-1

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-01A	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck center of room 0711A	NONE DETECTED	Gypsum Cellulose
01B	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck center of room 0711A	NONE DETECTED	Gypsum Cellulose
01C	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck center of hallway 0715	NONE DETECTED	Gypsum Cellulose
01D	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck NE of central pharmacy 0762	NONE DETECTED	Gypsum Cellulose
01E	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck center of kit check 0777	NONE DETECTED	Gypsum Cellulose
01F	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck south center of equipment storage/issue 0761	NONE DETECTED	Gypsum Cellulose
01G	Blue/gray sprayed-on fireproofing above ceiling on metal fluted deck center of men's restroom 0784	NONE DETECTED	Gypsum Cellulose

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.

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Job:

24-7086 UCDMC FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-2

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-02A	Red fire caulking above ceiling west wall at pipe penetration center of hallway 0715	NONE DETECTED	Synthetics Fibrous Glass
02B	Red fire caulking above ceiling west wall at pipe penetration center of hallway 0715	NONE DETECTED	Synthetics Fibrous Glass
03A	Green fire caulking above ceiling west wall at pipe penetration center of hallway 0715	NONE DETECTED	Pumice Fibrous Glass
03B	Green fire caulking above ceiling west wall at pipe penetration center of hallway 0715	NONE DETECTED	Pumice Fibrous Glass
04A	Gray HVAC seam sealant above ceiling on HVAC duct center of kit check 0777	NONE DETECTED	Calcite Synthetics
04B	Gray HVAC seam sealant above ceiling on HVAC duct center of kit check 0777	NONE DETECTED	Calcite Synthetics
05A	Tan fire sprinkler thread sealant above ceiling center of room 0711A	NONE DETECTED	Opagues Cellulose
05B	Tan fire sprinkler thread sealant above ceiling NE of central pharmacy 0762	NONE DETECTED	Opagues Cellulose

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.

ASBESTECH
11151 Sun Center Drive, Suite B
Rancho Cordova, California 95670
Tel.(916) 481-8902 asbestech@sbcglobal.net

Client:

Entek Consulting Group, Inc.
4200 Rocklin Rd., Suite 7
Rocklin, CA 95677

Job:

24-7086 UCDMC FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-3

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-06A	White drywall above ceiling west wall center of hallway 0715	NONE DETECTED	Gypsum Fibrous Glass
	White joint compound	NONE DETECTED	Calcite
06B	White drywall above ceiling north wall NE of central pharmacy 0762	NONE DETECTED	Gypsum Fibrous Glass
	White joint compound	NONE DETECTED	Calcite
06C	White drywall SE corner within equipment storage/issue 0761	NONE DETECTED	Gypsum Fibrous Glass
	White joint compound	NONE DETECTED	Calcite
06D	White drywall NW corner within equipment storage/issue 0761	NONE DETECTED	Gypsum Fibrous Glass
	White joint compound 1	NONE DETECTED	Calcite
	White joint compound 2	NONE DETECTED	Calcite
07A	Gray 2'x4' drop in acoustical ceiling tile, center of room 0711A	NONE DETECTED	Cellulose Fibrous Glass
07B	Gray 2'x4' drop in acoustical ceiling tile, south center of equipment storage/issue 0761	NONE DETECTED	Cellulose Fibrous Glass

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.

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Rancho Cordova, California 95670
Tel.(916) 481-8902 asbestech@sbcglobal.net

Client:

Entek Consulting Group, Inc.
4200 Rocklin Rd., Suite 7
Rocklin, CA 95677

Job:

24-7086 UCDCM FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-4

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-08A	Black 4" vinyl cove base, base of south wall system in equipment storage/issue 0761	NONE DETECTED	Calcite
	Tan mastic	NONE DETECTED	Calcite
08B	Black 4" vinyl cove base, base of east wall system in equipment storage/issue 0761	NONE DETECTED	Calcite
	Tan mastic	NONE DETECTED	Calcite
09A	Tan 4" vinyl cove base, south within room 0711A	NONE DETECTED	Calcite
	Tan mastic	NONE DETECTED	Calcite
09B	Tan 4" vinyl cove base, base of north wall system in equipment storage/issue 0761	NONE DETECTED	Calcite
	Tan mastic	NONE DETECTED	Calcite
10A	Multicolor carpet, west within kit check 0777	NONE DETECTED	Synthetics
	Yellow mastic	NONE DETECTED	Calcite

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.

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11151 Sun Center Drive, Suite B
Rancho Cordova, California 95670
Tel.(916) 481-8902 asbestech@sbcglobal.net

Client:

Entek Consulting Group, Inc.
4200 Rocklin Rd., Suite 7
Rocklin, CA 95677

Job:

24-7086 UCDMC FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-5

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-10B	Multicolor carpet, south within kit check 0777	NONE DETECTED	Synthetics
	Yellow mastic	NONE DETECTED	Calcite
11A	White & gray 12"x12" vinyl floor tile, SE within room 0771A	NONE DETECTED	Calcite
	Yellow mastic	NONE DETECTED	Synthetics
11B	White & gray 12"x12" vinyl floor tile, NE within central pharmacy 0762	NONE DETECTED	Calcite
	Yellow mastic	NONE DETECTED	Synthetics
	Gray leveler	NONE DETECTED	Calcite
12A	Gray 12"x12" vinyl floor tile, SE in equipment storage/issue 0761	NONE DETECTED	Calcite
12B	Gray 12"x12" vinyl floor tile, SE in equipment storage/issue 0761	NONE DETECTED	Calcite
13A	White 2"x2" ceramic floor tile, NE within restroom 0784	NONE DETECTED	Granular Mins.
	White grout	NONE DETECTED	Granular Mins.

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.

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Rancho Cordova, California 95670
Tel.(916) 481-8902 asbestech@sbcglobal.net

Client:

Entek Consulting Group, Inc.
4200 Rocklin Rd., Suite 7
Rocklin, CA 95677

Job:

24-7086 UCDCM FP&D
Davis Tower Ground Floor, 2315 Stockton Blvd.
Sacramento, Ca

BULK ASBESTOS ANALYSIS REPORT

LAB JOB # 71014-6

Date/Time Collected: 2/22/24

Date Received: 2/23/24

NVLAP Lab Code 101442-0

Date Analyzed: 2/26/24

<i>Sample No.</i>	<i>Color/Description</i>	<i>% Type Asbestos</i>	<i>Other Materials</i>
ECG-24-7086-13B	White 2"x2" ceramic floor tile, NE within restroom 0784	NONE DETECTED	Granular Mins.
	White grout	NONE DETECTED	Granular Mins.
14A	Gray concrete foundation, south in equipment storage/issue 0761	NONE DETECTED	Granular Mins.
14B	Gray concrete foundation, SE in room 0771A	NONE DETECTED	Granular Mins.

THE ANALYSIS USES POLARIZED LIGHT MICROSCOPY AND DISPERSION STAINING FOLLOWING E.P.A. METHOD 600/R-93/116. NON-FRIABLE MATERIALS WERE ANALYZED APPLYING THE SAME METHOD. THE LOWER DETECTION LIMIT IS <1 % WITH THE PROVISIO THAT PLM MAY NOT DETECT FIBERS <0.25 MICRONS IN DIAMETER THAT MAY BE PRESENT IN SAMPLES SUCH AS FLOOR TILES. IN ACCORDANCE WITH TITLE 22, CCR, SECTION 66261.24(a)(2)(A), THE MCL IS 1 %. SAMPLES WERE NOT COLLECTED BY ASBESTECH. THIS REPORT MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF ASBESTECH. THIS REPORT RELATES ONLY TO THE ITEMS TESTED. THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY N.V.L.A.P. OR ANY AGENCY OF THE U.S. GOVERNMENT. ASBESTECH ACCEPTS TECHNICAL RESPONSIBILITY FOR THIS REPORT AND DATE OF ISSUE.



BULK ASBESTOS MATERIAL *Analysis Request*

ENTEK CONSULTING GROUP, INC.

4200 ROCKLIN ROAD, SUITE 7

ROCKLIN, CA 95677

(916) 632-6800 PHONE

(916) 632-6812 FAX

mainoffice@entekgroup.com**Date of Sampling:** 2/22/24**Job Number:** 24-7086**Client Name:** UCDCM FP&D**Site Address:** Davis Tower – Ground Floor
2315 Stockton Boulevard
Sacramento, CA 95817**Lab:** Asbestech**Collected by:** Karl Suarez**Turnaround Time:** Wednesday, 2/28/24 By
End of Day**ANALYSIS REQUESTED:** Asbestos by PLM
with Dispersion Staining**Special Instructions:** Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.Please e-mail results at mainoffice@entekgroup.com and ksuarez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-24-7086-01A	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Center of Room 0711A
ECG-24-7086-01B	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Center of Room 0711A
ECG-24-7086-01C	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Center of Hallway 0715
ECG-24-7086-01D	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Northeast of Central Pharmacy 0762
ECG-24-7086-01E	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Center of Kit Check 0777
ECG-24-7086-01F	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, South Center of Equipment Storage/Issue 0761
ECG-24-7086-01G	Blue-Gray Sprayed-On Fireproofing – Above Ceiling on Metal Fluted Deck, Center of Men's Restroom 0784
ECG-24-7086-02A	Red Fire Caulking – Above Ceiling, West Wall at Pipe Penetration, Center of Hallway 0715
ECG-24-7086-02B	Red Fire Caulking – Above Ceiling, West Wall at Pipe Penetration, Center of Hallway 0715
ECG-24-7086-03A	Green Fire Caulking – Above Ceiling, West Wall at Pipe Penetration, Center of Hallway 0715

<https://entekgroupinc.sharepoint.com/sites/Entekgroup/Shared Documents/Clients/UCDCM - FP&D/24-7086 DT Bsmt Pharmacy - AsbPb/Bulk Asb/Bulk Asb Rqst Portrait 00-00-00.docx>

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Received by:**Date:**

2/23/24

Time:

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BULK ASBESTOS MATERIAL *Analysis Request*

ENTEK CONSULTING GROUP, INC.

4200 ROCKLIN ROAD, SUITE 7
ROCKLIN, CA 95677
(916) 632-6800 PHONE
(916) 632-6812 FAX
mainoffice@entekgroup.com

Date of Sampling: 2/22/24

Job Number: 24-7086

Client Name: UCDMC FP&D

Site Address: Davis Tower – Ground Floor
2315 Stockton Boulevard
Sacramento, CA 95817

Lab: Asbestech

Collected by: Karl Suarez

Turnaround Time: Wednesday, 2/28/24 By
End of Day

ANALYSIS REQUESTED: Asbestos by PLM
with Dispersion Staining

Special Instructions: Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-24-7086-03B	Green Fire Caulking – Above Ceiling, West Wall at Pipe Penetration, Center of Hallway 0715
ECG-24-7086-04A	Gray HVAC Seam Sealant – Above Ceiling, On HVAC Duct, Center of Kit Check 0777
ECG-24-7086-04B	Gray HVAC Seam Sealant – Above Ceiling, On HVAC Duct, Center of Kit Check 0777
ECG-24-7086-05A	Tan Fire Sprinkler Thread Sealant – Above Ceiling, Center of Room 0711A
ECG-24-7086-05B	Tan Fire Sprinkler Thread Sealant – Above Ceiling, Northeast of Central Pharmacy 0762
ECG-24-7086-06A	Drywall and Joint Compound – Above Ceiling, West Wall Center of Hallway 0715
ECG-24-7086-06B	Drywall and Joint Compound – Above Ceiling, North Wall Northeast of Central Pharmacy 0762
ECG-24-7086-06C	Drywall and Joint Compound – Southeast Corner Within Equipment Storage/Issue 0761
ECG-24-7086-06D	Drywall and Joint Compound – Northwest Corner Within Equipment Storage/Issue 0761
ECG-24-7086-07A	2' x 4' Drop-In Acoustical Ceiling Tile, Center of Room 0711A
ECG-24-7086-07B	2' x 4' Drop-In Acoustical Ceiling Tile, South Center of Equipment Storage/Issue 0761
ECG-24-7086-08A	4" Black Vinyl Cove Base with Tan Mastic, Base of South Wall System in Equipment Storage/Issue 0761

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Delivered by:

Karl Suarez

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Date:

2/23/24

Time:

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BULK ASBESTOS MATERIAL *Analysis Request*

ENTEK CONSULTING GROUP, INC.

4200 ROCKLIN ROAD, SUITE 7
 ROCKLIN, CA 95677
 (916) 632-6800 PHONE
 (916) 632-6812 FAX
mainoffice@entekgroup.com

Date of Sampling: 2/22/24

Job Number: 24-7086

Client Name: UCDCM FP&D

Site Address: Davis Tower – Ground Floor
 2315 Stockton Boulevard
 Sacramento, CA 95817

Lab: Asbestech

Collected by: Karl Suarez

Turnaround Time: Wednesday, 2/28/24 By
 End of Day

ANALYSIS REQUESTED: Asbestos by PLM
 with Dispersion Staining

Special Instructions: Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.

Please e-mail results at mainoffice@entekgroup.com and ksuarez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-24-7086-08B	4" Black Vinyl Cove Base with Tan Mastic, Base of East Wall System in Equipment Storage/Issue 0761
ECG-24-7086-09A	4" Tan Vinyl Cove Base with Tan Mastic, South within Room 0711A
ECG-24-7086-09B	4" Tan Vinyl Cove Base with Tan Mastic, Base of North Wall System in Equipment Storage/Issue 0761
ECG-24-7086-10A	Multicolor Carpet with Yellow Mastic, West within Kit Check 0777
ECG-24-7086-10B	Multicolor Carpet with Yellow Mastic, South within Kit Check 0777
ECG-24-7086-11A	12" x 12" White and Gray Vinyl Floor Tile with Yellow Mastic, Southeast within the Room 0771A
ECG-24-7086-11B	12" x 12" White and Gray Vinyl Floor Tile with Yellow Mastic, Northeast within Central Pharmacy 0762
ECG-24-7086-12A	12" x 12" Gray Vinyl Floor Tile with Clear Mastic, Southeast in Equipment Storage/Issue 0761
ECG-24-7086-12B	12" x 12" Gray Vinyl Floor Tile with Yellow Mastic, Southeast in Equipment Storage/Issue 0761
ECG-24-7086-13A	2" x 2" White Ceramic Floor Tile with White Grout, Northeast within Restroom 0784
ECG-24-7086-13B	2" x 2" White Ceramic Floor Tile with White Grout, Northeast within Restroom 0784

<https://entekgroupinc.sharepoint.com/sites/Entekgroup/Shared Documents/Clients/UCDCM - FP&D/24-7086 DT Bsmt Pharmacy - AsbPb/Bulk Asb/Bulk Asb Rqst Portrait 00-00-00.docx>

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Karl Suarez

Date:

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Date:

2/23/24

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BULK ASBESTOS MATERIAL *Analysis Request*

ENTEK CONSULTING GROUP, INC.

4200 ROCKLIN ROAD, SUITE 7

ROCKLIN, CA 95677

(916) 632-6800 PHONE

(916) 632-6812 FAX

mainoffice@entekgroup.com**Date of Sampling:** 2/22/24**Job Number:** 24-7086**Client Name:** UCDCM FP&D**Site Address:** Davis Tower – Ground Floor
2315 Stockton Boulevard
Sacramento, CA 95817**Lab:** Asbestech**Collected by:** Karl Suarez**Turnaround Time:** Wednesday, 2/28/24 By
End of Day**ANALYSIS REQUESTED:** Asbestos by PLM
with Dispersion Staining

Special Instructions: Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.

Please e-mail results at mainoffice@entekgroup.com and ksuarez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-24-7086-14A	Gray Concrete Foundation, South in Equipment Storage/Issue 0761
ECG-24-7086-14B	Gray Concrete Foundation, Southeast in Room 0771A

<https://entekgroupinc.sharepoint.com/sites/Entekgroup/Shared Documents/Clients/UCDCM - FP&D/24-7086 DT Bsmt Pharmacy - AsbPb/Bulk Asb/Bulk Asb Rqst Portrait 00-00-00.docx>

Delivered by:**Date:**

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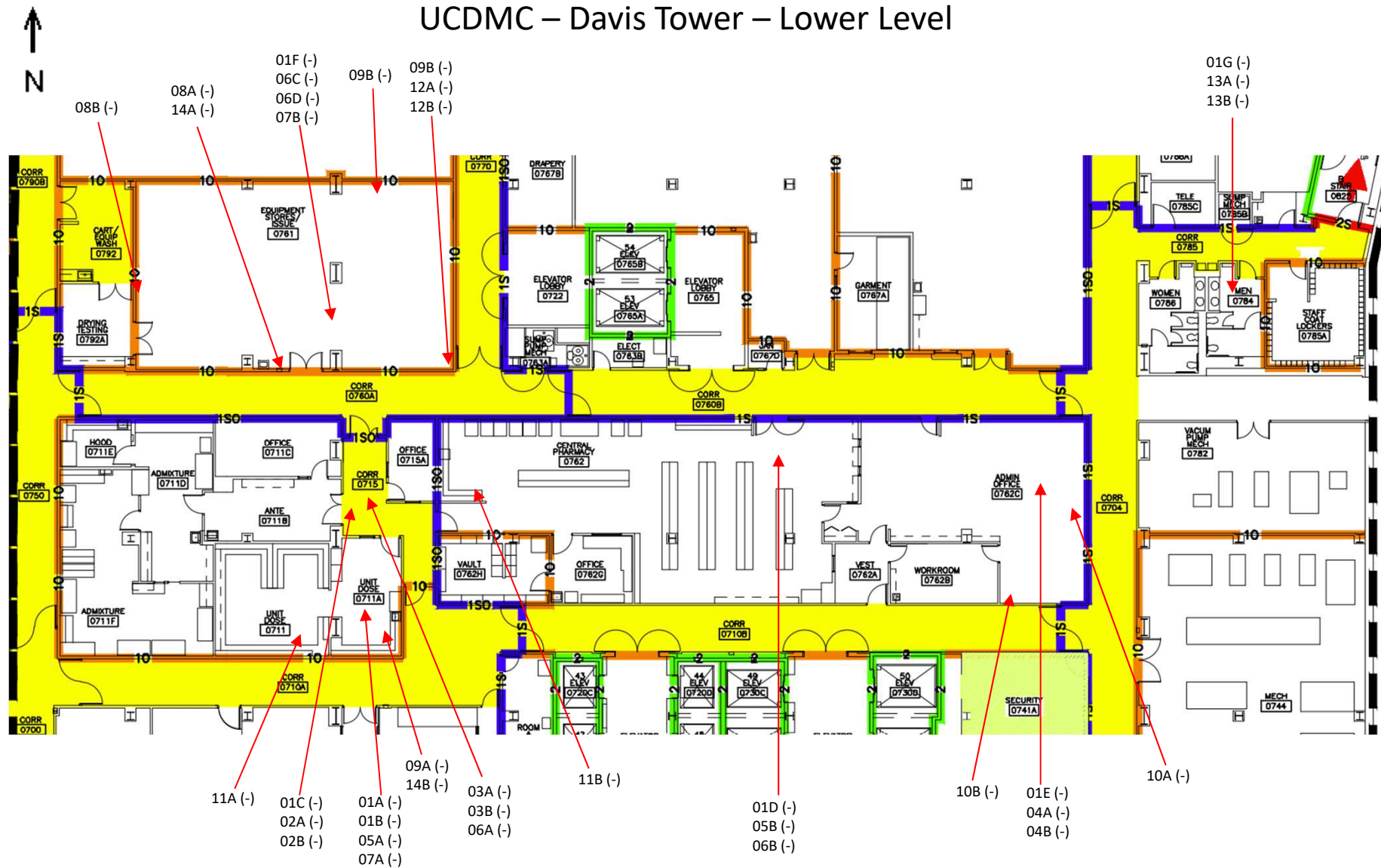
Received by:**Date:**

2/23/24

Time:

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UCDMC – Davis Tower – Lower Level



UCDMC FP&D
Davis Tower – Lower Level Pharmacy
2315 Stockton Boulevard
Sacramento, CA 95817

Entek Consulting Group, Inc.
4200 Rocklin Road, Suite 7
Rocklin, CA 95677
Map Not to Scale

Bulk Asbestos Sampling Map
Collected by Karl Suarez
On February 22, 2024
Project Number 24-7086

Asbestos Survey Form

(See Instructions)

777 12th Street, 3rd Floor
Sacramento, CA 95814
Office (916) 874-4800
Fax (916) 874-4899
Email:
asbestos@airquality.org

1. Purpose of Survey			☒ Renovation		☐ Demolition	
2. Facility Information						
Project Area(s) Description UC Davis Medical Center - Davis Tower - Lower Level Pharmacy						
Address 2315 Stockton Boulevard			City Sacramento		# of Structures 1	
3. Owner Information						
Name UC Davis Medical Center - Facilities Planning & Development						
Address 4800 2nd Avenue, Suite 3010			City/State Sacramento/CA		Zip 95817	
Contact Aaron Allen	Phone (916) 397-1086		Fax	Email aamallen@ucdavis.edu		
4. Consultant Information			Survey Date(s): February 22, 2024			
Company Name Entek Consulting Group, Inc.						
Name Karl Suarez					DOSH #23-7390	
Address 4200 Rocklin Road, Suite 7			City/State Rocklin, California		Zip 95677	
Phone (916) 632-6800	Fax (916) 632-6812	Email ksuarez@entekgroup.com		Signature 		
5. Client Information (If different than owner)			☐ General Contractor		☐ Insurance Company	
☐ Architect			☐ Property Manager		☐ Other _____	
Name						
Address			City/State		Zip 95678	
Contact	Phone		Fax		Email	
6. Have all of the suspect materials that will be disturbed been sampled?						☒ Yes ☐ No
If no, explain why:						
7. Summary of Total Asbestos Containing Material (ACM) Findings						
Regulated Asbestos Containing Material (RACM) (Includes materials subject to known mechanical removal and fire damaged materials)			Category II		Category I	
Square Ft.	Linear Ft.	Cubic Ft.	Square Ft.	Linear Ft.	Square Ft.	Linear Ft.
0	0	0	0	0	0	0
To receive future SMAQMD Rule updates and changes affecting your industry (check one box):						
☐ Please send e-mail notices to			☐ I will sign up myself at www.airquality.org/listserve/ to receive emailed notices.			
☒ I am already subscribed.		☐ I want the District to mail notices to the address on this application:			☐ Owner ☐ Consultant	

Asbestos Renovation/Demolition Notification Form

1	Building Department Permit Application # (if known) : _____		☒ Renovation (Do not complete Section 5) ☐ Demolition (Complete all sections) ☐ Ordered Demo - Attach ordered demo letter ☐ Emergency Demo - SMAQMD Emergency #: _____		
2	Contractor		Owner UC Davis Medical Center - FP&D		
	Address		Address 4800 2nd Avenue, Suite 3010		
	City, State / Zip		City, State / Zip Sacramento, CA / 95817		
	Email		Email aamallen@ucdavis.edu		
	Telephone		Telephone (916) 397-1086		
3	Structure Name Davis Tower		Renovation Area Lower Level Pharmacy		# of Floors 14
	Project Address 2315 Stockton Boulevard		City / Zip Sacramento / 95817		Year Built 1999
4	Preference for return of form	☐ E-mail :		☐ Other :	
DEMOLITION ONLY – Start date must be at least 10 working days from the day of your postmark or hand delivery of this form.					
5	Start Date _____		Revision # 1 2 3 4 5 6 7 8 9 (circle)		
	Completion Date _____		New Start Date _____		
			New Completion Date _____		
	Method of Demo (Check Applicable): ☐ Manual/Hand Tools ☐ Mechanical/Heavy Equipment ☐ Other				
Procedure to be followed if RACM is found or Category II material becomes friable:					
I have read and understand the directions. The information on this form is true and accurate. I certify that the asbestos survey conducted represents the facility as built.					
6	Applicant Name (Print)		☐ Owner		Permit may be issued on:
	Phone Number		☐ Rep / Agent		
	Applicant's Signature		☐ Contractor		
		Date			

Have DOSH Consultant complete and sign below OR attach completed Asbestos Survey Form and Consultant's report.

CONSULTANT USE ONLY	Company Name Entek Consulting Group, Inc.		Telephone (916) 632-6800	
	Surveyor Name Karl Suarez		DOSH # 23-7390	Survey Date 2/22/24
	Analytical Method PLM by Dispersion Staining		Pt Count Materials <10%? ☐ Yes ☒ No ☐ Declined by Client	
	Amount of RACM	Square Feet 0	Linear Feet 0	Cubic Feet 0
	Amount of Category I 0		Amount of Category II 0	
	Project Address 2315 Stockton Boulevard		City Sacramento	Zip 95817
	Suspect Materials Present? ☒ Yes ☐ No		Consultant's Signature	

SMAQMD USE ONLY

Date Received / Date Postmarked _____ Date Approved & Returned _____
Project # _____ Check # _____ Receipt # _____ Amount Paid _____ Staff _____

APPENDIX B

LEAD RELATED DOCUMENTS

- Lead in Paint Samples Analysis Report From Microtest
- Bulk Lead Material Analysis Request Form for Entek
- Lead Bulk Sample Location Drawing
- Lead Hazard Evaluation Report (CDPH 8552)

**MicroTest Laboratories, Inc. | AIHA ELPAT #160934**

3110 Gold Canal Dr, Ste. A, Rancho Cordova, CA 95670
PH 916.567.9808 | FX 916.404.0302
www.microtestlabsinc.com | service@microtestlabsinc.com

for office use only

Project ID**L34237****CLIENT INFORMATION**

Company Entek Consulting Group, Inc
Name Ryan Metzen
Address 4200 Rocklin Road, Suite 7
Rocklin, CA 95677
Phone 916.632.6800
Email mainoffice@entekgroup.com
rmetzen@entekgroup.com

SAMPLE

Date Thursday, February 22, 2024
Time

MicroTest Laboratories**Analytical Data****JOB SITE INFORMATION**

Sampler Karl Suarez
Project UCDCM FP&D
Site Davis Tower Level Pharmacy
Address 2315 Stockton Boulevard
Sacramento, CA 95817
Job # 24-7086
PO # 24-7086

EPA METHOD 7420/7000B

Client	Laboratory	Client	Reporting	Results	Units
Sample ID	Sample ID	Sample Location / Description	Limits	Comments	
ECG-24-7086-01Pb	L34237	Beige Paint on Drywall - Above Ceiling on Drywall Wall Throughout, Center of Hallway 0715	0.01%	<100	Wt % PPM

Date Received: Monday, February 26, 2024**Date Analyzed:** Wednesday, February 28, 2024**Date Reported:** Wednesday, February 28, 2024

Samples Received: 1

Samples Analyzed: 1

Analyst: Erich BowmanAuthorized Signatory: 
Kelly Favero - Lab Manager

This report applies to the standards and procedures indicated and to the specific samples analyzed. Samples have NOT been corrected for blank values.
Hotblock Preparation Method

EPA 3050B



BULK LEAD MATERIAL *Analysis Request*

ENTEK CONSULTING GROUP, INC.

4200 ROCKLIN ROAD, SUITE 7

ROCKLIN, CA 95677

(916) 632-6800 PHONE

(916) 632-6812 FAX

mainoffice@entekgroup.com

Project ID: L34237
Client: Entek
Receipt Date: 02/26/24
Count: 1 **TAT:** 2-day

Date of Sampling: 2/22/24**Job Number:** 24-7086**Client Name:** UCDCM FP&D

Site Address: Davis Tower Lower Level Pharmacy
2315 Stockton Boulevard
Sacramento, CA 95817

Lab: MicroTest**Collected by:** Karl Suarez

Turnaround Time: Wednesday, 2/28/24, By
End of Day

ANALYSIS REQUESTED: Lead by Flame
Atomic Absorption Spectroscopy

Special Instructions: *Please report result in PPM and % by weight. Please email results as soon as possible.*

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-24-7086-01Pb	Beige Paint on Drywall – Above Ceiling on Drywall Wall Throughout, Center of Hallway 0715

<https://entekgroupinc.sharepoint.com/sites/Entekgroup/Shared Documents/Clients/UCDCM - FP&D/24-7086 DT Bsmt Pharmacy - AsbPb/Bulk Pb/Bulk Pb Rqst Portrait 00-00-00.docx>

Delivered by:**Date:**2/26/24**Time:**10:14 AM/PM**Received by:****Date:**02/26/24**Time:**10:15 AM/PM

↑
N



Bulk Lead Sampling Map
Collected by Karl Suarez
On February 22, 2024
Project Number 24-7086

LEAD HAZARD EVALUATION REPORT**Section 1 — Date of Lead Hazard Evaluation** February 22, 2024**Section 2 — Type of Lead Hazard Evaluation (Check one box only)**

☒ Lead Inspection ☐ Risk assessment ☐ Clearance Inspection ☐ Other (specify) _____

Section 3 — Structure Where Lead Hazard Evaluation Was Conducted

Address [number, street, apartment (if applicable)]		City	County	Zip Code
2315 Stockton Boulevard		Sacramento	Sacramento	95817
Construction date (year) of structure	Type of structure		Children living in structure?	
1999	☐ Multi-unit building ☐ School or daycare ☐ Single family dwelling ☒ Other Hospital		☐ Yes ☒ No ☐ Don't Know	

Section 4 — Owner of Structure (if business/agency, list contact person)

Name		Telephone number	
UC Davis Medical Center - Facilities Planning & Development		(916) 397-1086	
Address [number, street, apartment (if applicable)]		City	State
2315 Stockton Boulevard		Sacramento	CA
			Zip Code
			95817

Section 5 — Results of Lead Hazard Evaluation (check all that apply)

☒ No lead-based paint detected ☒ Intact lead-based paint detected ☐ Deteriorated lead-based paint detected
☒ No lead hazards detected ☐ Lead-contaminated dust found ☐ Lead-contaminated soil found ☐ Other _____

Section 6 — Individual Conducting Lead Hazard Evaluation

Name		Telephone number	
Entek Consulting Group, Inc. - Karl Suarez		(916) 632-6800	
Address [number, street, apartment (if applicable)]		City	State
4200 Rocklin Road, Suite 7		Rocklin	CA
			Zip Code
			95677
CDPH certification number	Signature		Date
11068			2/22/24

Name and CDPH certification number of any other individuals conducting sampling or testing (if applicable)

N/A

Section 7 — Attachments

- A. A foundation diagram or sketch of the structure indicating the specific locations of each lead hazard or presence of lead-based paint;
B. Each testing method, device, and sampling procedure used;
C. All data collected, including quality control data, laboratory results, including laboratory name, address, and phone number.

First copy and attachments retained by inspector

Second copy and attachments retained by owner

Third copy only (no attachments) mailed or faxed to:

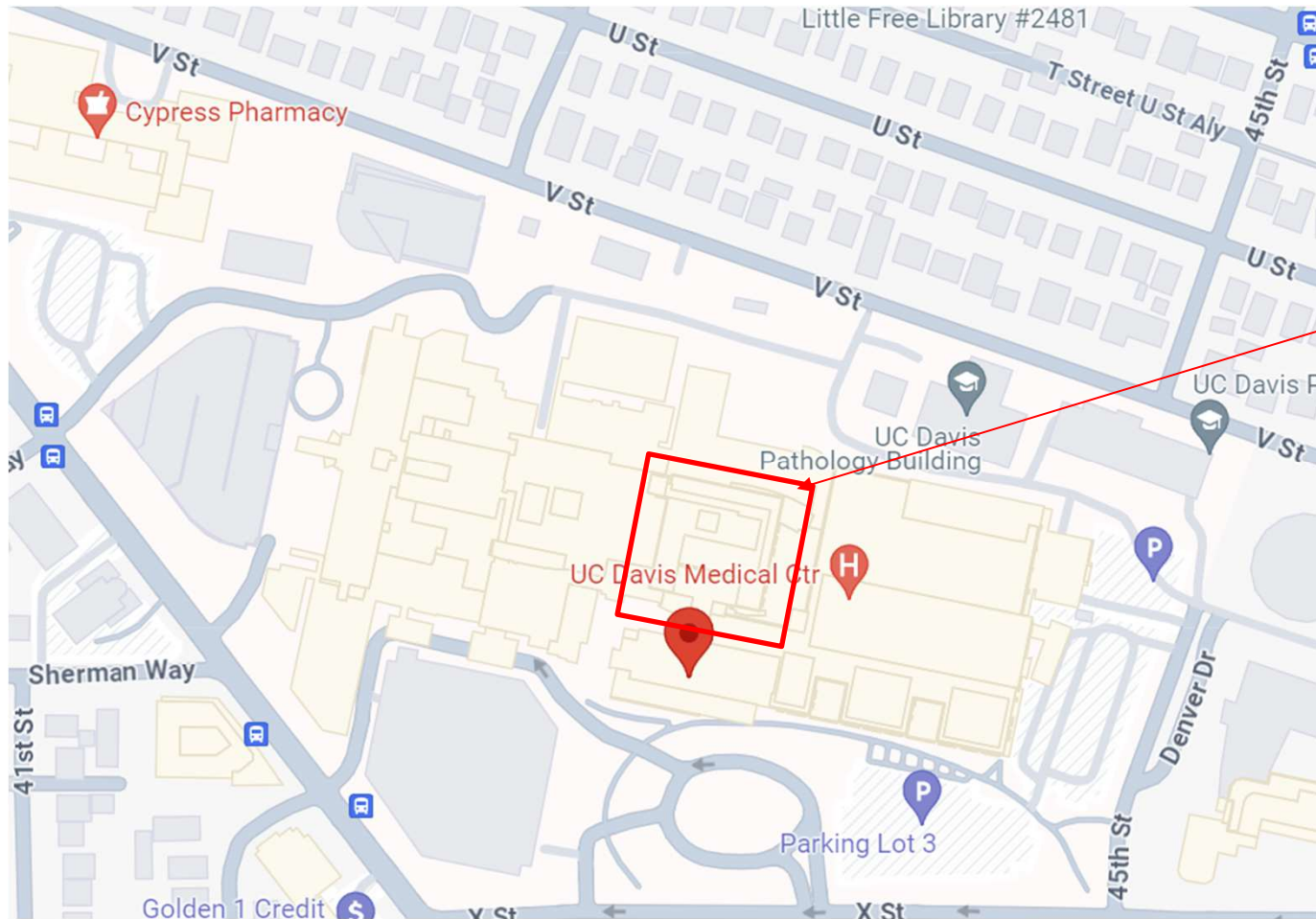
California Department of Public Health
Childhood Lead Poisoning Prevention Branch Reports
850 Marina Bay Parkway, Building P, Third Floor
Richmond, CA 94804-6403
Fax: (510) 620-5656

APPENDIX C

BACK UP DOCUMENTS

- Site Map
- Photo Log
- Inspector Accreditations and Certifications
- Laboratory Accreditations for Asbestos Analysis

UCDMC – Davis Tower – Site Map



Approximate
Location of
Davis Tower

UCDMC FP&D
Davis Tower – Lower Level Pharmacy
2315 Stockton Boulevard
Sacramento, CA 95817

Entek Consulting Group, Inc.
4200 Rocklin Road, Suite 7
Rocklin, CA 95677
Map Not to Scale

Site Map
Project Number 24-7086

Photo Log

Job Number:	24-7086	Date:	4/19/24
Client:	UC Davis Medical Center – Facilities Planning & Development		
Site Address:	Davis Tower – 2315 Stockton Boulevard, Sacramento, California 95817		

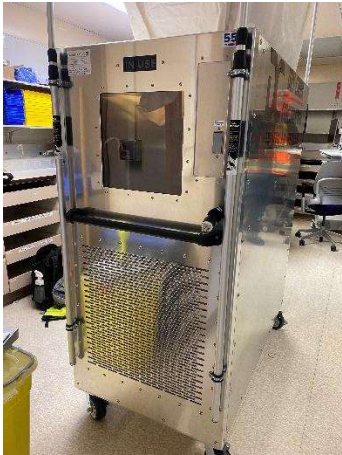
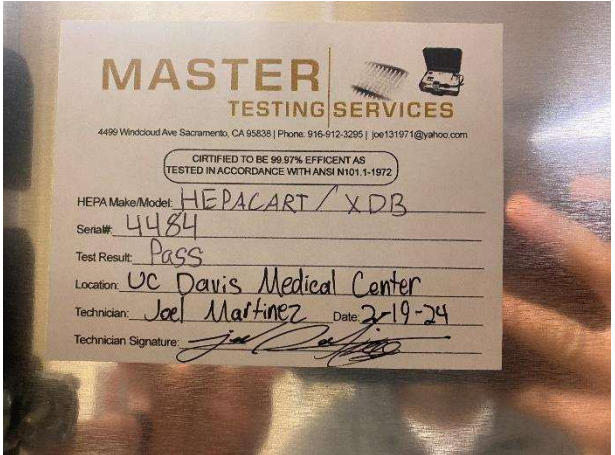
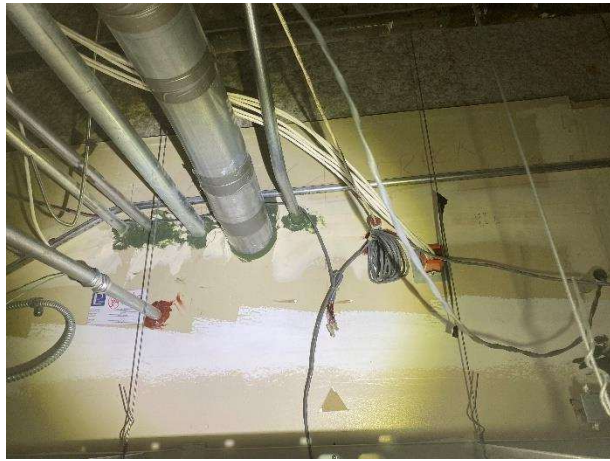
	
View of the HEPA cart used for the survey.	View of the DOP sticker showing the negative air machine in the HEPA cart showing that it was recently inspected and tested.
	
View above ceiling	View of the fiberglass insulation throughout

Photo Log

Job Number:	24-7086	Date:	4/19/24
Client:	UC Davis Medical Center – Facilities Planning & Development		
Site Address:	Davis Tower – 2315 Stockton Boulevard, Sacramento, California 95817		



View of the pipe penetrations through the drywall



View of the sprayed-on fireproofing on the metal fluted deck and overhead beams



View of the carpet and mastic throughout several areas



View of the floor tile and acoustical ceiling tiles throughout

Photo Log

Job Number:	24-7086	Date:	4/19/24
Client:	UC Davis Medical Center – Facilities Planning & Development		
Site Address:	Davis Tower – 2315 Stockton Boulevard, Sacramento, California 95817		

	
View of the vinyl cove base and associated mastic throughout	View of additional vinyl cove base and associated mastic throughout
	
View of the vinyl floor tile and associated mastic throughout	View of the ceramic floor tile within the restrooms

State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Karl S. Suarez

Name



Certification No. **23-7390**

Expires on **06/16/24**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:



Karl Suarez

CERTIFICATE TYPE:

Lead Inspector/Assessor
Lead Sampling Technician

NUMBER:

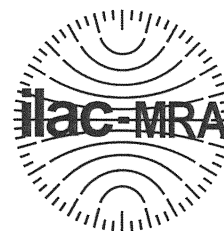
LRC-00011068
LRC-00008454

EXPIRATION DATE:

4/7/2025
3/25/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clpph or calling (800) 597-LEAD

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101442-0

ASBESTECH
Rancho Cordova, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

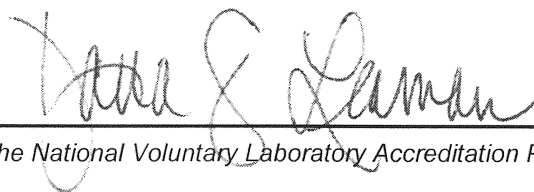
Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2023-07-01 through 2024-06-30

Effective Dates




For the National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

ASBESTECH

11151 Sun Center Drive, Suite B
Rancho Cordova, CA 95670
Mr. Tommy Conlon
Phone: 916-481-8902 Fax: 916-481-3975
Email: asbestech@sbcglobal.net
<http://www.asbestechlab.com>

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 101442-0

Bulk Asbestos Analysis

Code

18/A03

Description

EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

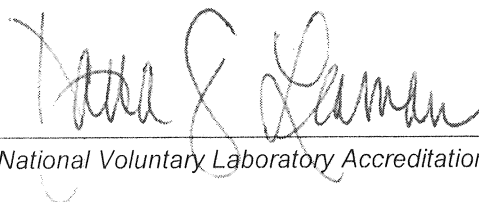
Airborne Asbestos Analysis

Code

18/A02

Description

U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.



For the National Voluntary Laboratory Accreditation Program



CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

**CERTIFICATE OF
ENVIRONMENTAL LABORATORY ACCREDITATION**

Is hereby granted to

MicroTest Laboratories, Inc.

3110 Gold Canal Drive

Rancho Cordova, CA 95670

Scope of the certificate is limited to the
"Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on compliance with applicable laws and regulations,
proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2974**

Effective Date: **7/1/2022**

Expiration Date: **6/30/2024**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Program Manager
Environmental Laboratory Accreditation Program



**CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Fields of Accreditation**



MicroTest Laboratories, Inc.

3110 Gold Canal Drive
Rancho Cordova, CA 95670
Phone: 9165679808

**Certificate Number: 2974
Expiration Date: 6/30/2024**

Field of Accreditation:114 - Inorganic Constituents in Hazardous Waste

114.345	002	Antimony	EPA 6020 B
114.345	003	Arsenic	EPA 6020 B
114.345	004	Barium	EPA 6020 B
114.345	005	Beryllium	EPA 6020 B
114.345	006	Cadmium	EPA 6020 B
114.345	008	Chromium	EPA 6020 B
114.345	009	Cobalt	EPA 6020 B
114.345	010	Copper	EPA 6020 B
114.345	012	Lead	EPA 6020 B
114.345	016	Nickel	EPA 6020 B
114.345	018	Selenium	EPA 6020 B
114.345	021	Thallium	EPA 6020 B
114.345	023	Zinc	EPA 6020 B
114.345	024	Molybdenum	EPA 6020 B
114.515	001	Lead	EPA 7420
114.545	001	Mercury	EPA 7471 B

Field of Accreditation:115 - Leaching/Extraction Tests and Physical Characteristics of Hazardous Waste

115.055	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II
115.085	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311

Field of Accreditation:121 - Bulk Asbestos Analysis of Hazardous Waste

121.010	001	Bulk Asbestos	EPA 600/M4-82-020

SECTION 01 56 20

REQUIREMENTS FOR CEILING ACCESS TO SPACES CONTAINING ASBESTOS

PART I - GENERAL

1.01 SECTION INCLUDES

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

PART II - HAZARDOUS MATERIAL SURVEY FINAL REPORT

See attached Hazardous Materials Survey Final Report for the project area dated April 22, 2024 at the end of this specification section.

PART III - EXECUTION

3.01 Training

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

3.02 Competent Person

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

3.03 Standard Access/Egress Procedures from Mini-Enclosure

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

vacuum and wet wiping techniques. All mini-enclosures and HEPA vacuums must be re-certified by a third-party using DOP testing every 6 months.

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

3.04 Air Sampling

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

3.05 Debris Clean-up

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

3.06 Personal Protective Equipment

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

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

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

- a. Dry sweeping is not permitted

- b. Employees must not walk on, crawl on or otherwise crush visible suspect asbestos containing debris
 - c. The control method must not result in a release of airborne fibers.
 - B. If the coverall tears or rips during the work activity, repair or replacement is required. Use duct tape to repair tears or rips to the coverall if feasible or exit and replace the coverall. Remove and bag coverall in mini-enclosure as in ceiling access procedure. If coveralls were torn, vacuum any noticeable debris from underlying clothing. Use two disposable coveralls to minimize contamination of street clothes when tearing is likely or when crawling on rough surfaces.
- 3.08 HEPA Filter Challenge Testing and Certification
 - A. All HEPA filtered equipment (including negative air units and vacuums) used must have passed onsite DOP testing within the last 6 months and must be re-certified after filter replacement or if moved offsite, including to another University building.
- 3.09 Access for Inspection after Ceiling Tile has been Removed
 - A. Inspection above the ceiling, after a ceiling tile has been moved using a mini-enclosure containment, may be performed with asbestos awareness training. Access of this type is limited to visual inspection through the ceiling opening. Full entry to the space or ceiling crawl must meet the other requirements of this section. Personnel who perform this work must be notified that asbestos is present in the area and which materials in the area contain asbestos.
- 3.10 Asbestos Waste Management
 - A. Personnel are required to appropriately bag all asbestos debris, disposable personal protective equipment, and other materials potentially contaminated with asbestos. Bags shall be clear, 6 mil, imprinted with the required asbestos warning label. Appropriate packaging includes double-bagging and wetting the materials in the inner bag. Each bag shall be legibly marked with (Site address and Generator Number will change with each project site location) The Generator is UC Davis Health EPA ID No. CAD076124981. The Generator address is 2315 Stockton Blvd., FSSB 2500, Sacramento, CA 95817.
 - B. For those projects generating five (5) or fewer bags of asbestos-contaminated materials, University Environmental Health and Safety (EH&S) will manage the disposal of the bags; contact EH&S at 916-734-2740 for disposal with at least one week's notice of the intent to dispose. Materials must be bagged and marked as described above prior to EH&S' acceptance.
 - C. Asbestos disposal is the responsibility of the Contractor on those projects generating more than five (5) bags of asbestos-contaminated material. If a Uniform Hazardous Waste Manifest is required for transportation, such manifest must be signed by a representative of the University EH&S. Contact EH&S with at least one week's notice of the intent to dispose.

END OF SECTION 01 56 20

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

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

1.06 TRANSPORTATION, DELIVERY AND HANDLING

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

1.07 STORAGE AND PROTECTION

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

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

1.08 SYSTEM COMPLETENESS

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

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 INSTALLATION OF PRODUCTS

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

3.02 Refer to the following Attachment:

- A. Request for Substitution Form.

END OF SECTION 01 61 00

REQUEST FOR SUBSTITUTION

Substitution #: _____ Submittal #: _____ Date: _____

Project#: _____ HCAI#: _____

PROJECT NAME: _____

TO: UC DAVIS HEALTH Facilities Design & Construction 4800 2ND Avenue, Suite 3010 Sacramento, CA95817 P: 916-734-7024 Attn.: <u>Craig Ganes –</u> <u>cgan@ucdavis.edu</u>	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): _____

<u>PRODUCT DATA:</u> 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 72 00

PREPARATION

PART I - GENERAL

1.01 SECTION INCLUDES

- A. Surveying and Field Engineering Services

1.02 RELATED SECTIONS

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

1.03 REGISTRATION REQUIREMENT

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

1.04 LINE AND GRADES

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 INSPECTION

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

3.02 SURVEY REFERENCE POINTS

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

3.03 SURVEY REQUIREMENTS

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

3.04 RECORDS

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

END OF SECTION 01 72 00

SECTION 01 73 00

CUTTING AND PATCHING

PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED SECTIONS

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

1.03 SUBMITTALS

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

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

1.04 NOTIFICATIONS

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

PART II - PRODUCTS

2.01 MATERIALS

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

PART III - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 CUTTING AND PATCHING

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

3.04 PERFORMANCE

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

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

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

3.05 Refer to the Following Attachment

A. Coring/Sawcutting Notification

END OF SECTION 01 73 00

CORING/SAWCUTTING NOTIFICATION

LOCATION: _____ PROJECT#: _____
TITLE: _____

TRACKING NUMBER: _____
(Provided by PO&M)

HCAI #: _____ DATE: _____

TO: Facilities Design & Construction UC Davis Health 4800 2nd Avenue, Suite 3010 Sacramento, CA 95817 P: 916-734-7024 <u>Craig Ganes – cgan@ucdavis.edu</u>	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

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 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 As-built Documents

1.02 RELATED SECTIONS

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

1.03 FILE FORMATS

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

1. All files will be submitted in JPEG

1.04 EQUIPMENT DATA AND OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Preparation of data shall be done by persons:

1. Trained and experienced in maintenance and operation of described products.
2. Familiar with requirements of this Section.
3. Skilled in technical writing to extent required for communication of essential data.
4. Skilled as drafters competent to prepare required drawings

B. O&M Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at time of Section Submittals. Submit reviewed manual content formatted and organized as required by this Section. Prepare in the form of a data and instructional manual.

C. Submit PDF electronic files of operation and maintenance manuals. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the University. The exception to electronic format will be indicated in the specific specification section requiring hard copies of the manual.

1. Name each indexed document file in composite electronic index with applicable item name. Include a completed electronically linked operation and maintenance directory.
 - a. List Project title and Project number and particular building as applicable.
 - b. Enable inserted reviewer comments on draft submittals.
2. Organization: Arrange content by systems under Section numbers and sequence in accordance with the Project Specifications Table of Contents.

D. Table of Contents, Each Volume: Provide title of Project, Project number, with names, addresses, and telephone numbers of University's Representative, as applicable, and **Contractor**, including name of contact person. Provide schedule of products and systems, indexed to content of the volume.

1. For each Product or System: List names addresses and telephone numbers of subcontractor, original supplier and manufacturer, as applicable, including name of contact person. Include name and address of local source of supplies and replacement parts.
2. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete information not applicable.
3. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project As-Builts Documents as maintenance drawings.
4. Additional Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 014500 – QUALITY CONTROL.
5. Warranties and Bonds: Include in each applicable section.

E. Manual for Materials and Finishes:

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

F. Manual for Equipment and Systems

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

manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

10. Control Data: Provide as installed control diagrams by controls manufacturer.
 11. Piping Data: Provide Contractor's coordination drawings, with color piping diagrams as installed. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 12. Design Data: Provide a listing in table of Contents for design data, with tabbed binder divider page and space for insertion of data.
 13. Reports: Include test and balancing reports as specified.
 14. Additional Requirements: As specified in individual Specification Sections.
- G. Instruction of University's Personnel: Instruct University designated personnel to their full and complete understanding, procedures necessary to operate and maintain equipment and systems on continuing basis. Provide training of staff.
1. Schedule: Before final inspection, instruct University designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months of completion.
 2. Basis of Information: Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
 3. Instructional Material: Prepare and insert additional data in the manual when need for such data becomes apparent during instruction.
- H. Equipment Data and Operation and Maintenance Instructions Submittals:
1. Submittals: Comply with administrative requirements specified in SECTION 013300 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 2. Preliminary Draft O&M Submittal: Submit electronic files of each manual at least **[30]** calendar days before commencing demonstration and training. University's Representative will review draft and return with comments.
 - a. The comments or corrections shall be incorporated into the Final O&M submittal.
 - b. Correct or revise each manual to comply with the University's Representatives comments. Submit electronic copies of each corrected manual within **[15]** calendar days of receipt of University's Representative's comments.
 - c. University's Representative will notify the **Contractor** when the edits have been accepted for incorporation into the final O&M submittal.
 3. Advance Submittals: For equipment, or component parts of equipment to be put into service during construction and operated by University, submit documents within ten (10) calendar days after equipment approval.
 4. Final O&M Submittal: After completion of instruction of University operation and maintenance personnel and final inspection, revise content of documents to include additional information deemed necessary from instruction experience of University's personnel and any changes made during construction. Submit each

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

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

1.05 SPARE PARTS, EXTRA STOCK AND MAINTENANCE MATERIALS

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

1.06 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 1. List of Documents: Include a table of contents for each O&M and emergency, operations listed per CSI Specification number.
 2. List of Systems and Subsystems: Include references to operation and maintenance manuals that contain information about each system.
 3. List of Equipment: List equipment for each system, organized by system. For pieces of equipment not part of system, list separately.
 4. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists,

assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

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

1.07 MAINTENANCE AGREEMENTS

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

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

1.08 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.

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

1.09 WARRANTIES AND GUARANTEES

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

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

D. Warranty Submittal

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

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

1.10 AS-BUILT DOCUMENTS

A. Definitions:

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

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

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

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

the Contract Documents:

- 1) Provide a two-digit numerical suffix that starts with .01 and ascends for every supplemental sheet:
Example: If the supplemental sheet contains sketches that describe changes to the hypothetical sheet "A1-01" the first supplemental sheet will be numbered "A1-01.01".
- 2) The sheet name and number are to be similar in text size and location to the sheet being supplemented.
- 3) Include supplemental sheets in bookmarks.

E. As-Built Schedule: Provide As-Built schedule per SECTION 013200 CONTRACT SCHEDULES

1. Format Requirements:

- a. Schedule to be in PDF format.
- b. File naming conventions:

- 1) YY_MMDD_ University's Project Number_As-Built_Schedule

F. As-Built Shop drawings:

1. Format Requirements:

- a. File naming convention for shop drawings:

- 1) YY_MMDD_ University's Project Number_ShopDwg_Spec
Section Number

G. As-built Documents Submittal: Submit all As-Built Documents together after Final Completion and in accordance with SECTION 017700 CLOSEOUT PROCEDURES. Allow 10 business days for initial review and for each resubmittal.

1.11 AS-BUILT PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
1. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
2. Format: Submit Product Data as annotated PDF electronic file Include As-Built Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.12 AS-BUILT PRODUCT SAMPLES

A. Preparation: Mark Samples to identify the material and location or use on project; indicate finish designations of materials and products, where designations are indicated on Drawings. Cross-reference Samples with corresponding Product Data submitted.

1. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
1. Note related Change Orders, As-Built Specifications, and As-Built Drawings where applicable.
2. Format: Submit As-Built Samples in same size and format as indicated for each sample in the specification's sections. Pack samples securely, with protective wrapping. Include As-Built Samples directory organized by Specification Section number and title.
3. Each Sample will be labeled with Manufacturer, Model, Product Number, CSI Section and UC Davis Health Project Name and Number.

1.13 PHOTOGRAPHS

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

1.14 CONSENT OF SURETY AND FINAL CERTIFICATES

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 Refer to the following attachments

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

END OF SECTION 017800

GUARANTEE

Project Title: _____

Project Location: _____

Project Number: _____ DATE: _____

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

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

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

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

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

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

SUBCONTRACTOR

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

Contractor License Classification & Number: _____

Address: _____

Telephone Number: _____

CONTRACTOR

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

Contractor License Classification & Number: _____

Address: _____

Telephone Number: _____

REPORT OF WORK REQUIRED BY WARRANTY

To:	Craig Ganes, University Representative
From:	

[illegible]

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 _____ 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. Action Items must be categorized as appropriate.
- C. Action List: This is a list that is maintained and updated by the CxA that includes all Action Items that relate to Cx activities.
- D. Commissioning (Cx): The process of ensuring that all building systems perform interactively according to the design intent and that the system operations are efficient and cost effective and meet the University's functional needs.
- E. Commissioning Agent (CxA): The individual retained by the University who will oversee the Cx process, develop and stipulate many of the Cx requirements (including FPTs), manage the Cx process, and ensure and verify that systems and equipment are installed, and tested to meet the University's requirements.
- F. Commissioning Coordinator (CC): The **Contractor** shall provide a Commissioning Coordinator. The CxA, the University's Representative and the CC will comprise a commissioning management team. While the CxA leads the overall commissioning process, the CC is responsible for managing contractors in their day-to-day performance of the specified commissioning work. The CC is an employee of the **Contractor** who is regularly and frequently on site. Qualifications for the Commissioning Coordinator include experience and excellent abilities to schedule, coordinate and manage subcontractors. The following tasks are some of the critical items included in the CC's scope of work:
 - 1. Integrating the specified commissioning activities into the overall contract construction schedule, updating the schedule and providing three-week look-ahead schedules showing the upcoming commissioning related activities.
 - 2. Providing all commissioning submittals to the University's Representative and CxA.
 - a. O&M Manuals per Division 017700 Close-out Procedures and 017800 Close-out Submittals

3. Coordinating University training and ensuring that training is provided in accordance with the Division 017700 Close-out Procedures and the technical specifications.
 4. Ensuring that subcontractor and supplier review and complete the CxA provided FPT procedures and forms then submitted in accordance with the specifications. This includes providing written comments (even if no exception is taken) regarding issues pertaining to safety, equipment protection/warranty and appropriateness of the procedure for the systems as provided from all required FPT participants for each FPT.
 5. Coordinating development and submittal of specified flushing, cleaning and start-up procedures and ensuring that these procedures are completed, and documentation is submitted.
 - a. Providing test reports and progress reports in accordance with the 017800 Close-out Submittals, commissioning, and technical specifications.
 6. Managing the **Contractor** participation in the FTP process in accordance with the commissioning specifications.
 7. Managing the **Contractor** participation in resolution of issues identified during pre-commissioning meetings and during the commissioning process.
 8. Ensuring that subcontractors perform preliminary testing to verify readiness for final FPT demonstrations, submitting documented verification that systems will pass functional tests with acceptable results as documented in the FPTs and coordinating the demonstration of the FPTs to the University and the CxA.
 9. Coordinating repeat FPTs that fail due to contract deficiencies until acceptable results are achieved and managing the reimbursement of the University's costs for repeated tests in accordance with the commissioning specifications.
- G. Commissioning Plan: This is a detailed document prepared and maintained by the CxA that describes the entire commissioning process.
- H. Commissioning Specifications (Cx specs): Includes the Cx specification section and Cx-related subsections of other specifications. All **Contractor** requirements relating to Cx.
- I. Commissioning Team: The parties involved in the commissioning process for any given system. The Cx Team will include a core group involved with all systems. This core group will typically include the CxA, the University's Cx coordinator, and **Contractor** CC and/or MEP Coordinator. At any given point the team may include the project manager, members of the design team, the project inspector, product representatives, and operation and maintenance personnel.
- J. **Contractor**: As used herein, **Contractor** is a general reference to the installing parties and can therefore refer to the **Contractor**, the subcontractors, or vendors as inferred by its usage.

- K. Construction Phase: Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. **Contractor** and subcontractors complete the installation complete start-up documentation, submit O&M information, establish trends, and perform other applicable requirements to get the systems started. The Construction Phase will generally end upon completed start-up and TAB of systems and equipment.
- L. Contract Documents: The documents governing the responsibilities and relationships between the parties involved in the construction of the project including, but not necessarily limited to, the agreement/contract, construction plans and drawings, specifications, addenda, and change orders.
- M. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.
- N. Functional Completion: A milestone that marks the completion of the Acceptance Phase and successful documentation of the FPTs by the CxA.
- O. Functional Performance Testing (FPT): This process verifies that the systems within the commissioning scope function in accordance with the Contract Documents, the University's design intent and the Design Team's Basis of Design. The process includes the documented testing of the systems under actual and simulated operating conditions. Functional Performance Test (FTP) procedures are detailed instructions that allow experienced system technicians to perform the FPTs with repeatable results. The repeatability of the procedures and results validate the tests. Final performance testing of systems will begin only after the **Contractor** certifies that such systems are completely installed and ready for functional testing and after the CxA has completed the subsequent installation verification process for the systems to be tested.
- P. Installation Verification Process: This process includes the on-site review of related system components for conformance to the Contract Documents. Upon receipt of the completed **Contractor's** System Readiness Manual, the CxA will conduct this review and verify system readiness for final functional testing procedures. The CxA will document issues identified during this process and assign them to the appropriate party for resolution.
- Q. MEP Coordinator: **Contractor's** staff member who is responsible for all MEP equipment and system installation, coordination, and start-up is the primary contact for the Cx Agent and shall be responsible to organize and lead the start-up and commissioning meetings, tracks response to Action Items from Cx Agent and generate minutes.
- R. Ready to Commission statement: The subcontractor's written statement, through the System Readiness Checklist (SRC), that the equipment or system described has been completely installed, started, and tested to ensure that it has met all the requirements of the contract documents and is ready for commissioning.
- S. Start-up: Refers to the quality control process whereby the **Contractor** verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the start-up checklists, energizes the device, verifies it is in proper working order and ready for dynamic testing, and completes the start-up tests.

- T. System Readiness Checklists (SRCs): These checklists are provided by the CxA and include equipment installation and start-up items specified to be performed and verified by the **Contractor**. These checklists shall be compiled along with associated start-up forms by the **Contractor** to create the **Contractor's** System Readiness Plan. They shall be completed during installation and returned to the CxA as components of the **Contractor's** System Readiness Manual prior to the final CxA installation verification and functional performance testing process.
- U. System Readiness Manual: This document includes, for each system within the commissioning scope of work, completed and signed versions of each form submitted by the **Contractor's** .
- V. System Readiness Plan: This document shall be completed by the **Contractor** and submitted to the CxA prior to the final installation verification and functional performance testing process. By submitting these completed forms, the **Contractor** signals that the relevant systems are installed, operational and will meet functional testing acceptance criteria. The System Readiness Plan is compiled by the **Contractor** and includes, for each system within the commissioning scope of work, the System Readiness Checklists provided by the CxA, followed by the associated **Contractor's** Start-up and Test Forms. The **Contractor** System Readiness Plan shall be submitted to the CxA for review and approval prior to installation of the systems.

1.03 REFERENCES

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

1.04 SYSTEMS TO BE COMMISSIONED

- A. All systems and equipment identified in the contract documents as having quality assurance or acceptance testing requirements are included in SYSTEMS TO BE COMMISSIONED by reference.
- B. All systems and equipment identified in the contract documents as requiring startup are included in SYSTEMS TO BE COMMISSIONED by reference.
- C. All systems and equipment identified in the contract documents requiring training are included in SYSTEMS TO BE COMMISSIONED by reference.
- D. Commissioning shall be system based.
 - 1. Equipment and sub-assemblies are to be installed, started and tested as components of each respective system rather than as a category of equipment or by specification section.
- E. The systems to be commissioned shall include but are not limited to the following:
 - 1. Air Handling Units
 - 2. Exhaust Fans
 - 3. HTHW Heat Exchangers
 - 4. Pumps
 - 5. Fan Coils
 - 6. Terminal Devices (VAV boxes)
 - 7. Sump Pumps
 - 8. Air Transfer Fans
 - 9. Hot Water Heaters
 - 10. Building Control System - Direct Digital Control System
 - 11. Energy Management System
 - 12. Workshop Airflow Control System
 - 13. Hydronic Systems
 - 14. Heat Exchangers
 - 15. Automated Lighting control systems
 - 16. Emergency generators
 - 17. Transfer switches

18. Environmental Rooms (hot or cold)
19. Utility Meters and sub-metering system
20. VFDs
21. Power to Mechanical Systems
22. Lighting Inverter
23. Irrigation Systems
24. Window Switches related to natural ventilation control
25. Solar Photovoltaic Power Systems
26. Solar Domestic Hot Water Systems
27. Water Reuse Systems
28. VRF Systems
29. Radiant Heaters
30. Heat Recovery boxes
31. Stair Pressurization Fans
32. Irrigation systems
33. Anaerobic Digester
34. Renewable Energy Systems
35. Fire alarm / Fire Detection System.
36. Data Systems.
37. Audio/Visual Systems.
38. Intercom / Telecom Systems.
39. Miscellaneous Low Voltage Systems.
40. Pneumatic Tube System.
41. Building Envelope.
42. Other Systems as Specified.

1.05 CONSTRUCTION AND ACCEPTANCE PHASE COMMISSIONING

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

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

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

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

1.06 SUBMITTALS

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

PART II - PRODUCTS

2.01 TEST EQUIPMENT

- A. The **Contractor** shall supply all personnel and equipment for the demonstration and testing, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. **Contractor** supplied personnel must be competent with and knowledgeable of all project-specific systems, and automation hardware and software. All training documentation, O&Ms, and submittals shall be at the job site before functional testing commences.
- B. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and control systems in Division 23.
- C. Special equipment, tools and instruments (only available from vendor/Subs, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be provided by the **Contractor** and left on site, for the CxA to use during functional testing, seasonal testing, and deferred testing. The equipment, tools, and instruments will be returned to the vendor/Subs after successful conclusion of the commissioning effort.
- D. The controls contractor shall provide the CxA with temporary software license to be loaded on the CxA's computer, and any necessary network connection cables, for accessing the direct digital control system field panels for system testing. The controls contractor shall also provide a palm device (if applicable) with attachments, software, and cables, to check setpoint values of terminal device controllers. The controls contractor shall provide the CxA with log on ID, password, and LAN IP connection criteria for remote connection to direct digital control system. All the software, cables, and modems provided to the CxA will be returned at the successful conclusion of the commissioning effort.
- E. All testing equipment used by the contractors shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Document Specifications (Project Manual). If not otherwise noted, the following minimum requirements apply to test and measurement equipment: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.1°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART III - EXECUTION

3.01 AFTER AWARD OF CONTRACT

- A. The **Contractor** shall identify the person on their staff who will serve as the Commissioning Coordinator (CC). This person shall be responsible for all startup and commissioning issues on the project. Specific duties are identified in Part 1 of this Section.
- B. Within the first 30 calendar days of the project the **Contractor** shall meet with the University and the commissioning agent to discuss the process to be used on the project for managing communication to and from the Cx agent. This is to include the means for communication issues, commissioning reviews, processing submittals, RFIs, change orders, etc., meeting minutes, schedule information, Cx agent observations, and the action item lists. If a mutually agreeable process cannot be agreed upon, the Cx agent's process and software tools will be utilized.
- C. Within the first 60 days of the project there will be a meeting of the GC, the Cx agent and the key subcontractor's personnel to review how the Cx process will be implemented on the project and how the communication and documentation requirements will be met. The subcontractors are expected to send the staff that will be participating in the start-up and commissioning meetings.
- D. The **Contractor** will submit a schedule listing the key startup and Cx activities. The initial schedule can be general in nature. As the project progresses, the details on the schedule must be sufficient to list the activities of each **Contractor** for each phase of the project and what work must be accomplished before each listed task.
- E. The **Contractor** is to identify the team members from each subcontractor who will be participating in the start-up and commissioning meetings. This list is to include the name and contact information for the subcontractor's commissioning coordinator.
- F. The **Contractor** is to compile a listing of all factory tests that will take place prior to the start of the start-up and commissioning meetings. The consolidated list, along with an approximation of when they are expected to take place, shall be forwarded to the Cx agent.

3.02 Cx MEETINGS

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

- B. The meetings will initially be held every second or third week as appropriate, and then increase in frequency to weekly as the bulk of the start-up and commissioning work is taking place.
- C. During each meeting an updated start-up and commissioning schedule will be distributed. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.
- D. During the meetings a consolidated training, O&M, and attic stock list drawn from the contract document requirements will be distributed. Decisions on the O&M review, when the training will take place, and how the stock will be turned over the University will be made based on this document. In addition to the hard copies distributed at the meeting, an electronic version shall be forwarded to the Cx agent and the University.
- E. Minutes of the start-up and commissioning meetings will be generated and distributed by the Commissioning Coordinator (CC). The minutes are to incorporate findings from the Cx agent. In addition to the hard copies distributed at the meeting, electronic versions shall be forwarded to the Cx agent and the University.
- F. The updated FPTs will be provided to the **Contractor** by the Cx agent.
- G. The **Contractor** and the subcontractors will be required to coordinate their activities, and work collaboratively, with the test and balance contractor hired by the University.
- H. The **Contractor** will coordinate the schedules for two review meetings to be led by the Cx agent. The first will be a comprehensive test and balance review and needs to include the mechanical subcontractor's wet and dry side foreman. The second meeting will be a controls review. This meeting is to be attended by the controls subcontractor's lead on the project and the programmer. Each meeting is to last at least two hours.

3.03 FIELD START-UP AND TESTING

- A. The dates for all field start-up activities shall be listed on the start-up and commissioning schedule.
- B. The CxA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional checklists to be completed, during the startup process.
- C. The TAB contractor submits their TAB plan, along with the TAB Plan Review Checklist, for approval by the CxA prior to starting TAB work.
- D. In general, the checkout and performance verification proceeds from simple to complex, from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.

- E. The CxA shall review shop drawings and material certifications, review of reports from independent testing agencies, independent on-site periodic construction observation and attendance of selected quality control-related meetings (e. g., Pre-installation Conferences).
- F. Pre-Functional Test Phase:
 - 1. The **Contractor** shall prepare the equipment and systems for start-up in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. Start-up shall be performed by the **Contractor's** and/or manufacturer's start-up technicians in accordance with the Contract Documents, industry standard guidelines and the guidelines of the equipment and systems manufacturers. The **Contractor** shall test the systems to verify that they perform in accordance with the Contract Documents, including the commissioning FPT procedures.
 - 2. The CxA will witness equipment start up and testing. The **Contractor** shall notify the CxA in writing at least fourteen (14) calendar days in advance of the start-up and testing dates so that the CxA can schedule attendance. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA. When scheduled start-up activities are not executed because of lack of preparation or coordination by the **Contractor**, the **Contractor** will be subject to back-charges in accordance with the Contract Documents.
 - 3. The **Contractor** shall complete and compile all start-up forms, test forms and SRCs for the System Readiness Manual and submit to the CxA.
 - 4. Upon receipt of the completed System Readiness Manual forms, the CxA will perform an Installation Verification by providing various inspections and back-checks of the completed System Readiness Manual forms. Issues notes during this process will be documented by the CxA in the Commissioning Issues Log.
 - 5. Upon acceptance of the System Readiness Manual, which includes the draft TAB report, functional performance testing shall be scheduled. Functional performance testing shall not commence until all critical issues identified during the Installation Verification process are resolved.
- G. Upon completion of the start-up and contractually required work, the **Contractor** shall submit a 'Ready to Commission' document to the University for the Specific Equipment and/or system that is complete. It is only after this document is received that the FPTs will commence.

3.04 Functional Performance Testing:

- A. Functional Performance Testing of commissioned systems shall begin after all critical issues discovered during the installation verification process have been corrected.
- B. The procedure for developing and performing the FPTs shall be as follows:
 - 1. The **Contractor** shall provide the equipment and commissioning submittals as specified in the Contract Documents.

2. The Commissioning Authority will draft the FPT procedures based on the **Contractor's** submittals as approved by the Design Team. The draft procedures will be submitted to the Commissioning Team for review.
3. Each **Contractor** and equipment supplier that is specified as an FPT participant in the FPT Summary Tables in the specifications shall participate in the development and performance of the associated FPTs. Each FPT participant shall provide written comments on the associated FPT procedures regarding each of the following issues:
 - a. Verify that the procedures can be performed without compromising the safety of the participants
 - b. Verify that the procedures can be performed without compromising the warranties of equipment, components, and systems
 - c. Verify that the procedures are appropriate for the equipment, components and systems as provided
4. The CxA will complete the working drafts of the FPT procedures.
5. Subcontractors and suppliers shall provide the personnel, expertise and test equipment to operate and maintain the systems during testing.
6. The **Contractor** shall test all systems within the commissioning scope of work, using the FPT procedures until the acceptable results specified in the FPT procedure are verified and documented. If necessary to obtain acceptable results, the **Contractor** may consult with the CxA to acquire clarification and resolve issues. The CxA will be available for on-site assistance of this nature.
7. The **Contractor** shall submit documentation that verifies that the acceptable results specified in the FPT procedures have been verified and that they are ready to demonstrate the FPTs with acceptable results. Acceptable documentation consists of completed FPT record forms which document acceptable FPT results or indication on the Systems Readiness Checklists that the **Contractor's** pre-functional testing has verified that functional performance testing of the equipment and associated system demonstrate the acceptable results as specified.
8. After the CxA has accepted the **Contractor's** documentation of acceptable results, the FPT shall be conducted and demonstrated to the CxA. If acceptable results are not demonstrated for an FPT, the **Contractor** shall resolve the issue(s) and the demonstration shall be repeated.

9. The **Contractor** shall verify and document acceptable FPT results for all equipment components and systems. The FPTs may be demonstrated for a sample of the systems that comply with all of the following criteria. This process is referred to in this document as “demonstration sampling”.
 - a. There shall be many of the systems with similar components that have identical sequences of operation which are implemented using identical control software programming.
 - b. The components and systems to be included in the Demonstration Samples will be chosen by the CxA at the time of demonstration.
 - c. The sample size will be in accordance with the Functional Performance Test (FPT) Demonstration Sampling Tables in the specifications.
 - d. Acceptable results must be demonstrated for the entire sample. If the FPT results are not acceptable due to a lack of preparation or coordination by the **Contractor** for any system or component sampled, the FPT shall be demonstrated for all the systems and components for which it was written. Whenever the demonstrated results are not acceptable, the **Contractor** shall make corrections and the FPT shall be demonstrated again. The cost of back-checking FPTs with unacceptable results is not included in the Commissioning Authority’s scope of work. Back-charging applies to additional back-checking required due to lack of preparation by **Contractor**.
10. The CC is responsible for scheduling and coordinating functional testing activities. The **Contractor** shall demonstrate the FPTs after they have verified that performing the FPTs will yield the documented acceptable results. The **Contractor** is subject to back-charging, as specified herein, if acceptable results are not demonstrated because of work that should have been verified during pre-demonstration testing prior to the submittal of the System Readiness Manual. Acceptable results must be obtained during a single demonstration. No more than two delays of less than 15 minutes each are acceptable for each test.
 - a. In addition to conducting the functional tests developed by the CxA, the **Contractor** shall be required to complete all start-up and testing procedures as specified elsewhere in the Contract Documents.
 - b. Where the CxA requires BMS trending, the CxA will provide a points list within the FPT form that may include both hardware (input/output) and software (virtual) points and appropriate trending intervals.
11. The **Contractor** shall provide trend data to the CxA in electronic format. As a University approved alternative, the **Contractor** can provide the CxA remote access to the BMS and provide training that will allow the CxA to directly download trend data.
12. The CxA will analyze and review the trend data and associated system performance.

3.05 Cx AGENT Functional Performance Testing (FPT)

- A. Upon receipt of the Ready to Cx statement, the Cx Agent will coordinate a time with the **Contractor** to witness the FPTs.
- B. The CxA develops specific equipment and system functional performance test procedures. The **Contractor** and manufacturer review the procedures to make sure the tests are safe for the equipment provided.
- C. The functional test procedures are executed by the **Contractors**, under the direction of, and documented by the CxA.
- D. The CxA will direct a TAB verification, with support from the TAB **Contractor**, to verify the values reported in the final TAB report.
- E. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
- F. All deficiencies noted will be tracked via the CxA issues log. The **Contractor** will be responsible for obtaining sign-off of corrected items.
 - 1. The **Contractor** is responsible for scheduling and coordinating commissioning activities. The **Contractor** shall reimburse the University for the cost of commissioning activities that must be repeated because of a lack of preparation or coordination by the **Contractor**. Reimbursable costs include CxA fees for services billed at the CxA's standard hourly rate. Activities subject to back-charging include: Repeated back-checking: Commissioning issues are documented in the Commissioning Issues Log. The **Contractor** shall submit a brief written statement describing when and how each issue has been resolved, which shall be added to the Issues Log maintained by the CxA. The CxA will back-check these issues on a one-time-per-issue basis to verify they have been resolved. If the back-checked issues that have not been resolved as reported, the associated cost of the unsuccessful back-check shall be subject to back-charging.
 - 2. Repeated installation verification: Once the **Contractor** has submitted the completed System Readiness Manual forms, the CxA will perform final installation verifications on selected systems. Discrepancies discovered will be reported in the Commissioning Issues Log. Back-checking the correction of these discrepancies shall be subject to back-charging.
 - 3. Repeated witnessing of FPT demonstrations: As specified in this section, the **Contractor** demonstrates the functional performance tests after they have verified that performing the FPTs will yield the documented acceptable results. The cost of witnessing demonstrations that do not demonstrate specified acceptance criteria shall be subject to back-charging.

3.06 SAMPLING

- A. As noted in the specifications, multiple identical pieces of non-life-safety or otherwise non-critical equipment will be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
- B. Sampling strategy referenced in the Specifications as the “xx% Sampling—yy% Failure Rule” is defined by the following example:
 - 1. xx = the percent of the group of identical equipment to be included in each sample.
 - 2. yy = the percent of the sample that if failing, will require another sample to be tested.
- C. The example below describes a 20% Sampling—10% Failure Rule.
 - 1. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.” If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
 - 2. If 10% of the units in the second sample fail, test all remaining units in the whole group. If at any point, frequent failures are occurring, and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

3.07 FAILURE DUE TO MANUFACTURER DEFECT:

- A. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the **Contractor**, the University, the A/E, or the CxA. In such case, the **Contractor** shall provide the University with the following:
 - 1. Within one week of notification **Contractor** or manufacturer’s representative shall examine all other identical units making a record of the findings. The findings shall be provided to the University within two weeks of the original notice.

2. Within two weeks of the original notification, the **Contractor** or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation. The University will determine whether a replacement of all identical units or a repair is acceptable.
3. Two examples of the proposed solution will be installed by the **Contractor** and the PM will be allowed to test the installations for up to one week, upon which the University will decide whether to accept the solution. Upon acceptance, the **Contractor** and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

3.08 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the University, A/E, and CxA. These tests will be conducted in the same manner as the seasonal tests as soon as possible.
- B. Seasonal Testing: During the warranty period, seasonal testing shall be completed as part of this contract. Seasonal testing is intended to test the performance of systems under full load conditions that cannot be simulated during the functional testing period. For example, it is impossible to test the heating system under full load conditions in July, so the heating system would be full load tested during the winter months. The CxA shall coordinate this activity. Tests will be executed, documented, and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and As-Built documents 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.

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PHARMACY REMODEL

END OF SECTION 01 91 00

SECTION 02070 SELECTIVE DEMOLITION

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include:
 - 1. Provide selective demolition as indicated on the drawings and as required by new construction.
 - 2. Asbestos and hazardous materials demolition or removal work is not part of this contract.

1.02 SUBMITTALS

- A. Submit for approval selective demolition schedule, including schedule and methods for capping and continuing utility service.

1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Use experienced workmen.

1.04 PROJECT CONDITIONS

- A. Coordinate all demolition work with Owner, with special attention to noise, dust, debris removal, or other disturbances.
- B. Schedule utility shutdowns at least 48 hours in advance. Maintain fire protection services during demolition operations.
- C. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose off site.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 DEMOLITION

- A. Do not damage building elements and improvements indicated to remain.
- B. All items not listed for “salvage and return to Owner” remain property of Owner, and shall be collected for reuse or recycling as directed by the Owner’s Representative. Contractor shall not remove any items of salvage or recycle value from the project site without the express permission of the Owner’s Representative.
- C. Do not close or obstruct streets, walkways, driveways or other occupied or used spaces or facilities without the written permission of the Owner and authorities having jurisdiction. Do

not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

- D. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

3.02 SCHEDULE

- A. Items to remain in place and protected for reuse: See section 01390 – Green Building Policy Implementation.
- B. Items to be salvaged for reinstallation in this project:
- C. Items to be salvaged and delivered to Owner:
 - 1. Doors and hardware
 - 2. Toilet accessories
 - 3. Light fixtures
 - 4. Plumbing fixtures
- D. Utilities requiring interruption, capping, or removal.

END OF SECTION 02070

SECTION 05400 COLD-FORMED METAL FRAMING

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work of this Section shall include all materials and installation necessary to provide all cold formed metal framing.
- B. This Section includes: (sheetmetal) as shown and detailed:
 - 1. Interior load-bearing wall framing
 - 2. FAs shown and detailed on the Drawings and specified herein.
- C. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for subflooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
 - 2. Division 9 for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.

1.02 DEFINITIONS

- A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95% of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.
- B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.03 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
- C. Mill certificates signed by steel sheet producer **[or test reports from a qualified independent testing agency]** indicating steel sheet complies with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Product Test/Evaluation Reports: From a qualified testing agency, such as the International Code Council (ICC), indicating that each of the following complies with requirements, based on comprehensive testing of current products in accordance with the current building code:

1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

1.04 QUALITY ASSURANCE

- A. Mill certificates signed by steel sheet producer [or test reports from a qualified independent testing agency] indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, [ductility,] and galvanized-coating thickness.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code – Steel," and AWS D1.3, "Structural Welding Code – Sheet Steel."
- D. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
- E. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" [or "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the following] for calculating structural characteristics of cold-formed metal framing.
 1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."
- F. VOC compliance certificate signed by manufacturers certifying compliance of their products with regulations of authorities having jurisdiction over volatile organic compounds (VOCs).

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers shall be certified Steel Stud Manufacturers Association (SSMA) members.

2.02 MATERIALS

- A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: [33 (230)].
2. Coating: [G60 (Z180)].
3. Grade: [33 (230) or C, Type 1 or 2].

2.03 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade [36] [55], threaded carbon-steel [hex-headed] [headless, hooked] [headless, with encased end threaded,] bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by [hot-dip process according to ASTM A 153/A 153M, Class C] [mechanically deposition according to ASTM B 695, Class 50].
- C. Expansion Anchors: Hilti KB-TZ, Simpson Strong-Bolt, or equal with current ICC ES report.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated with current ICC ES report.
- E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.04 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

2.05 GYPSUM SHEATHING

- A. Sheathing: Comply with requirements in Division 9 Section.

2.06 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of $\frac{1}{8}$ " in 10' (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus $\frac{1}{8}$ " (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of $\frac{1}{8}$ " (3 mm).

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- D. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of $\frac{1}{8}$ " in 10' (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus $\frac{1}{8}$ " (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: **As indicated.**
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54" (1370 mm) apart. Fasten at each stud intersection.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.05 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 1. Install joists over supporting frame with a minimum end bearing of 1-½" (38 mm).
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

- C. Space joists not more than 2" (51 mm) from abutting walls, and as follows:
 - 1. Joist Spacing: **As indicated.**
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at each end of joists and at intervals indicated.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.06 FIELD QUALITY CONTROL

- A. Testing: University shall engage a qualified independent testing agency to perform field quality-control testing.
- B. Field and shop welds shall be subject to inspection and testing.
- C. Testing agency shall report test results promptly and in writing to Contractor and University's Representative.
- D. Remove and replace Work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of corrected Work with specified requirements.

3.07 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.
- C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.
- D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

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

END OF SECTION 05400

SECTION 05410 METAL STUD SYSTEM

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation for Metal Stud System, as shown and detailed on the drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 9 – GYPSUM BOARD

1.02 SUBMITTALS

- A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA & SAMPLES.
- B. Product Data: Submit manufacturer's specification, data, and installation instructions

1.03 PRODUCT HANDLING

- A. General: Refer to Section 01310 – COORDINATION.

1.04 MAINTENANCE

- A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES.
- B. Guarantee: Provide in required form for a period of one (1) year from date of final acceptance by University.

PART II - PRODUCTS

2.01 MATERIALS

- A. Metal stud framing members consisting of: C-track for floor runners, headers and sills, wall studs and slotted track for top track runners.
 - 1. Manufacturers: ClarkDietrich Building Systems, CEMCO, or approved equal.
- B. Stud Types:
 - 1. General: Provide types designed for screw application of gypsum wallboard. Stud fabricated by manufacture that belongs to the Steel Stud Manufacturers

Association (SSMA) meeting requirements of the International Code Council (ICC) #3064P.

2. Metal Studs: ASTM C645, non-load bearing type with punched webs; roll-formed electro-galvanized steel sheet in the following minimum gages: **PM to edit:**

16ga typical framing unless noted otherwise on drawings.

16ga for king and trimmer studs at door/window openings and wing wall ends. Studs widths as shown on the drawings.

C. Miscellaneous Framing:

1. Furring:

- a) 20ga electro-galvanized steel sheet, roll-formed, HAT: 2- $\frac{3}{4}$ " x $\frac{7}{8}$ " deep with $\frac{1}{2}$ " wide flanges.
- b) Zee: 1- $\frac{1}{2}$ " x 1- $\frac{1}{2}$ ".
- c) 20ga electro-galvanized sheet, roll-formed. Resilient RC channels.

2. Floor runners or C-Track: **PM to edit: 16ga Un-punched track.**

3. Top Runner or Slotted Track: **PM to edit: 16ga deep leg punched track.**

4. Stud Stiffeners: $\frac{3}{4}$ " cold rolled steel weighing not less than 300 lbs. per 1000 lineal feet; rust-inhibitive coated.

5. Channels: 2- $\frac{1}{2}$ " cold rolled steel weighing not less than 300 lbs. per 1000 lineal feet; rust inhibitive coated.

6. Backing Plates: 16ga C-track or plate. Sizes and types as shown on drawings.

D. FASTENERS:

1. Expansion Anchors: Hilti, Inc. KB-TZ (*or KB-TZ2 after March 1, 2021*), Simpson Strong-Tie Co. Inc. Strong-Bolt or equal with current ICC ES report.

2. Powder Driven Fasteners:

- a. Hilti, Inc.; DS32P10 4.5mm diameter, 32mm shank carbon steel, zinc plated. Used with DX76.
- b. Ramset, or equal with current ICC ES report.

3. Screws: Type S bugle head; sizes recommended by gypsum board manufacturer.

- E. Wire Hangers: 12 gage galvanized soft steel wire.
- F. Neoprene Tape: ASTM D1056, Grade SCE41, soft sponge neoprene with adhesive one side; black; $\frac{1}{4}$ " x $\frac{1}{2}$ ", unless otherwise shown.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Section 01310 – COORDINATION.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.

3.02 INSTALLATION

- A. Metal Framing:
 - 1. General: ANSI A97.2.
 - 2. Structural Studs: MLSFA (Metal Lath/Steel Framing Association).
- B. Metal Stud Partitions:
 - 1. General: Install complete with matching runner tracks and accessories. Align runner tracks accurately to partition layouts.
 - 2. Floor Runners: Secure with $\frac{3}{8}$ " diameter expansion bolts or powder driven fasteners at least 1" long, where permitted by code. Space fasteners 4" from ends

- of each piece; maximum 16" on center intermediately; minimum of 2 fasteners per piece of runner.
3. Ceiling Runners/tracks: Fasten to Wide Flange or Concrete Deck with powder driven fasteners per manufacturer's recommendations.
 4. Studs: Gages, depths, and spacing shown. Where not shown, provide per stud manufacturer's recommendations.
 5. Stiffeners: 2 rows at third points for studs with finish one side only; one row at midpoint for studs with finish both sides. Snap into punched web of each stud; nest laps and wire tie.
- C. Backing Plates: Install at all casework, cabinets; grab bars and other equipment requiring attachment to walls or partitions. Attach to metal studs by welds or sheet metal screws as applicable.
- D. Suspended Gypsum Board Ceilings and Soffits:
1. General: Install for gypsum wallboard ceilings. Where ductwork or other obstructions prohibit use of specified system, provide heavier system per referenced Standard.
 2. Hanger Wires: Space at 48" on center both ways; do not support more than 16 square feet of ceiling per wire. Locate a hanger within 6" of end of main runners.
 3. Runner Channels: Space not over 48" on center; wrap each hanger wire twice around runner channel.
 4. Furring Channels: Attach to runner channels at 16" on center with snap-on clips, wire, or other acceptable methods.
 5. Openings: Reinforce as required for support of mechanical and electrical fixtures.
 6. Seismic Restraint: As shown on drawings.
- 3.03 CLEANING
- A. See Section 01740 – CLEANING.

END OF SECTION 05410

SECTION 05500
MISCELLANEOUS METAL FABRICATIONS

PART I - GENERAL

1.01 DESCRIPTION:

- A. Scope: Work under this Section shall include all material and installation necessary to provide Miscellaneous Metal Fabrications, as shown and detailed on the drawing and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 5 – STRUCTURAL STEEL

1.02 QUALITY ASSURANCE

- A. References:
 - 1. 2019 California Building Code (CBC)
 - 2. American Institute for Steel Construction (AISC): Steel Construction Manual, 16th Edition.
 - 3. American Welding Society (AWS): D1.1 Structural Welding Code
 - 4. National Association of Architectural Metal Manufacturers (NAAMM): Standards
 - 5. Steel Structures Painting Council (SSPC): Painting Manual
- B. QUALIFICATIONS:
 - 1. General: Fabricator and installer specializing in the work of this Section with minimum three (3) years documented experience.
 - 2. Welding: Performed by certified welders per AWS

1.03 SUBMITTALS

- A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Submit manufacture and installation details, including fastenings.
- C. Product Data: None required for specified products; required for alternate products.
- D. VOC compliance certificate signed by manufacturers certifying compliance of their products with regulations of authorities having jurisdiction over volatile organic compounds (VOCs).

1.04 PRODUCT HANDLING

- A. General: Refer to Section 01310 – COORDINATION

- B. Items Requiring Anchorage in Concrete: Deliver with complete setting diagrams, measurements, ICC evaluation reports, and manufacturer's written instructions.

1.05 GUARANTEE

- A. General: Refer to Section 01770 – CONTRACT CLOSEOUT.
- B. Period: Provide in required form for a period of one (1) year from the date of final acceptance by the University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

- A. Steel Shapes:
 - 1. General: ASTM A36 except ASTM A992 for wide-flange shapes
 - 2. Steel Tubing: ASTM A500, Grade B
 - 3. Steel Pipe: ASTM A53, Grade B
- B. Fastenings:
 - 1. General: Bolts, nuts, screws, washers, and other various fastenings necessary for proper erection of work. Galvanized steel fastenings or other non-rusting types for exterior steel work.
 - 2. Exposed in Finished Surfaces: Tamperproof countersunk Phillips flat head screws, unless otherwise shown; finish to match adjacent surfaces.
 - 3. Plastic Screw Anchors:
 - a. Type HUD, manufactured by Hilti, Inc.
 - b. Star Anchors and Specialty Fasteners, Inc., or equal.
- C. Post-installed Anchors:
 - 1. Except where indicated on the drawings, post-installed anchors shall consist of the following anchor types as provided by Hilti, Inc. or approved equal.
 - a. Anchorage to concrete
 - i) Adhesive anchors for cracked/uncracked concrete use:
 - 1) Hilti HIT-HY 200 Safe Set System with HILTI HIT-Z rod per ICC ESR-3187
 - 2) Hilti HIT-HY 200 Safe Set System with HILTI Hollow Drill Bit System with threaded rod per ICC ESR-3187.
 - 3) Hilti HIT-RE 500-SD Epoxy Adhesive Anchoring System with threaded rod per ICC ESR-2322 for slow cure applications
 - 4) ITW Red Head EPCON G5 per ICC-ESR 1137
 - 5) Powers PE 1000 per ICC-ESR 2583

- ii) Medium duty mechanical anchors for cracked/uncracked concrete
 - 1) Hilti Kwik HUS EZ and Kwik HUS EZ-I screw anchors per ICC ESR-3027
 - 2) Hilti Kwik BOLT-TZ expansion anchors per ICC ESR-1917
 - 3) ITW Red Head PER ICC-ESR 2427
 - 4) Powers Power-Stud SD2 per ICC-ESR 2502
 - 5) Hilti KB-TZ2 expansion anchors per ICC ESR-4266
- iii) Heavy duty mechanical anchors for cracked concrete use
 - 1) Hilti HDA undercut anchors per ICC ESR 1546
 - 2) Hilti HSL-3 expansion anchors per ICC ESR 1545
 - 3) USP DUC undercut anchors per ICC ESR 1970
- b) Rebar doweling into concrete
 - i) Adhesive anchors for cracked concrete use
 - 1) Hilti HIT-HY 200 Safe Set System with Hilti Hollow Drill Bit System with continuously deformed rebar per ICC ESR-3187.
 - 2) Hilti HIT-RE 500-SD Epoxy Adhesive Anchoring System with continuously deformed rebar per ICC ESR-2322.
 - 3) ITW Red Head EPCON G5 per ICC-ESR 1137
 - 4) Powers PE 1000 per ICC-ESR 2583
- 2) Anchor capacity used in design shall be based on the technical data published by the manufacturer or such other method as approved by the Structural Engineer of Record. Substitution requests for alternate products must be approved in writing by the Structural Engineer of Record prior to use. Contractor shall provide calculations demonstrating that the substituted product is capable of achieving the performance values of the specified product. Substitutions will be evaluated by their having an ICC ESR showing compliance with the relevant building code for seismic uses, load resistance, installation category, and availability of comprehensive installation instructions. Adhesive anchor evaluation will also consider creep, in-service temperature and installation temperature.
- 3) Install anchors per the manufacturer instructions, as included in the anchor packaging.
- 4) Overhead adhesive anchors must follow manufacturer's printed installation procedures.
- 5) The contractor shall arrange an anchor manufacturer's representative to provide onsite installation training for all of their anchoring products specified. The Structural Engineer of Record must receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of installing anchors.
- 6) Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete. Install anchors in accordance with spacing and edge clearances indicated on the drawings.
- 7) Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the

position of the reinforcing bars at the locations of the concrete anchors, by Hilti Ferrosan, GPR, X-Ray, chipping or other means.

D. Non-Shrink Grout:

1. "Embco" manufactured by BASF Corporation
2. W.R. Meadows, Inc, or equal.

E. Primer: Per Section 09900 – PAINTING

2.02 FABRICATION

A. Workmanship:

1. General: Shop assemble work in largest practical sections; minimize field connections. Grind smooth parts exposed to view; remove weld marks and leave free of fabrication marks. Miter corners and edges unless otherwise shown. Make members true to length so assembling may be done without fillers. Bends, twists, open joints in finished members, or projecting edges or corners at connections will not be permitted. Miter, cope, and block carefully to produce tight hairline joints. Provide lugs, clips, connections, bolts, and fastenings necessary to complete fabrication.
2. Galvanizing: Treat all areas burned off or damaged during fabrication with specified repair compound.
3. Reinforcement: Provide proper reinforcement for hardware, and other fabricated metal work, as required.
4. Welding: Use sequence welding to minimize distortion and heat stresses. Weld by shielded electric arc process per AWS. Use continuous welding along entire area of contact, except where spot welding is permitted. Grind all welds smooth on exposed surfaces. Spot welding not permitted on exposed surfaces.
5. Shop Painting: Per SSPC standards.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Section 01310 – COORDINATION
- B. Conditions of Work in Place: Carefully examine before beginning work; report defects.
- C. Job Measurements: Take field measurements; report discrepancies between plan and field dimensions.

3.02 INSTALLATION

A. Performance:

1. General: Install with workmen skilled in the particular type of work required and in accordance with the written instructions of the manufacturers.
2. Coordination: Deliver miscellaneous metal items to be installed in concrete or masonry, complete with all clips, anchors or bolts necessary to secure them in place.
3. Workmanship: Set work plumb and true; properly assemble and erect in a rigid and workmanlike manner. Do cutting, punching, drilling and tapping for attachment of other work coming into contact with fabricated metal work where indicated or as directed. Do necessary cutting, drilling, and fitting for installation of fabricated metal work. Execute drilling, cutting, and fitting carefully; when required, fit work at job before finishing. No burning in field permitted. Replace, or repair parts damaged or injured during erection in an acceptable manner. Drill holes for fasteners to exact diameter as recommended by fastener manufacturer.

Oversized holes or holes not properly located that produce misalignment of fastener will be rejected.

4. Field Touch-up: Touch-up damaged surfaces and field welds of steel, scheduled to be painted, per SSPC standards.
5. Protection: After erection, provide proper protection for fabricated metal items from other construction operations.

B. Installation:

1. Bollards:

- a. General: Set in concrete and fill, as shown.
- b. Removable Bollards: Set sleeves with removable cap in concrete as shown; provide smooth insertion and removal of bollard.

2. Ladder:

- a. General: Fasten at top, bottom, and intermediate points not over 6'-0" apart with brackets for fastening; use expansion bolts, unless otherwise shown.
- b. Safety Post: Install at center line of top two rungs on all fixed ladders located below roof hatches. Verify smooth and proper extension to full 42" height.

C. Non-shrink grout:

1. Convene pre-application meeting two (2) weeks before start of application of non-shrink grout.
2. Require attendance of parties directly affecting work of this section, including contractor, architect, engineer, applicator, and manufacturer's representative.
3. Review materials, surface preparation, forming, mixing, placing, curing, protection, and coordination with other work.

END OF SECTION 05500

**SECTION 06100
ROUGH CARPENTRY**

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work of this Section shall include all materials and installation necessary to provide Rough Carpentry as shown and detailed on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. References:

1. American Forest and Paper Association (AFPA): National Design Specification for Wood Construction.
2. American Lumber Standards Committee (ALSC): Grading Standards.
3. American National Standards Institute (ANSI):
 - a. Mat-Formed Wood Particleboard: ANSI A208.1.
 - b. Basic Hardboard: ANSI/AHA A135.4.
4. American Plywood Association (APA): Standard Grading Rules.
5. American Wood Preservers Association (AWPA): Preservative and fire retardant treatment.
6. Redwood Inspection Service (RIS): Standard Specifications for Grades of California Redwood Lumber.
7. West Coast Lumber Inspection Bureau (WCLIB): Standard Grading Rules No. 16.
8. Western Wood Products Association (WWPA): Western Lumber Grading Rules.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data and installation instructions for review.

B. Certificates:

1. Pressure Treatment: Submit mill certificate verifying compliance as specified, for each shipment received, in addition to a stamp on each piece of lumber, from an approved independent inspecting agency operating under the overview of the ALSC.
2. Lumber Grades: Where lumber and plywood is exposed to view and clear finished, provide Certificates in lieu of grade stamping and trade marks.

1.04 SITE CONDITIONS

A. Protection:

1. Temporary Supports: Provide adequate centering, bracing, and shoring for protection of structure during construction.

PART II - PRODUCTS

2.01 MATERIALS

A. Grading:

1. General: NBS PS-20 and applicable Lumberman's Association rules, under which each lumber species is produced.
2. Grade Marking:
 - a. Lumber: CBC; each piece of lumber, factory marked with official grade mark of grading agency.
 - b. Plywood: CBC and PS 1; each panel legibly identified for type, grade and species by APA grade.

B. Lumber:

1. General: Sizes dressed as shown, surfaced four (4) sides; 19% maximum moisture content; air or kiln dried. Boxed heart will not be permitted in lumber 3x or thicker.
2. Lumber Grades:
 - a. General: Douglas fir-larch; to 4" thickness - No. 1; 6" thickness and larger - Select Structural.
 - b. Sills:
 - 1) General: Pressure treated douglas fir-larch – No. 2 or better; AWPB marked or branded.
 - 2) Non-bearing Stud Walls: Redwood, where specifically shown.
 - c. Posts, Beams and Stringers: Douglas fir-larch - Select Structural.
 - d. Miscellaneous Framing:
 - 1) Douglas Fir-Larch: Blocking, nailers, furring, bridging and stripping; Construction or No. 2 grade.
 - 2) Redwood: Where specifically shown; Foundation Grade, unless otherwise noted.

C. Plywood: APA Structural I, with exterior glue; [tongue and groove at unblocked floor sheathing only]; sizes as shown.

D. Wood Treatment:

1. Western Wood Treating; factory applied treatment, unless otherwise noted, J. H. Baxter Co., or equal.
2. Fire Retardant: AWPAC Treatment C20, Exterior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25.
3. Wood Preservative
 - a. Pressure Treatment: In accordance with AWPAC Standard U1 using water borne preservative.
 - b. Surface Application: Clear type following the Use Categories suggested by AWPAC.

E. Sheathing:

1. Insulation Sheathing: ASTM C1289, nail base type, tongue and groove; thermal conductivity as shown.
2. Gypsum Sheathing: ASTM C1396/C1396M, size as shown.

F. Rough Hardware:

1. Hangers, Clamps, Straps and Anchors:
 - a. Simpson Strong Tie Co., Inc.; types as shown.
 - b. Comparable products with current ICC approval and equal or greater rated load capacity, TECO/LUMBERLOCK, TECO Products, or equal.
 - c. Special Fabrications: Per Division 5 – MISCELLANEOUS METAL FABRICATIONS.
2. Fasteners:
 - a. Nails: FS FF-N-105, common wire; hot-dipped galvanized for pressure preservative treated and exterior work; electro galvanized for other work. Box and sinker nails not permitted.
 - b. Bolts and Nuts:
 - 1) General: ASTM A307, Grade A.
 - 2) Expansion Bolts:
 - a) Metal anchored to concrete: products with current ICC approval and equal or greater rated load capacity, Hilti, Inc., or equal. Exterior application shall be stainless steel.

- b) Press treated wood anchored to concrete: stainless steel with current ICC approval and equal or greater rated load capacity, Hilti, Inc., or equal.
- c. Screws: Wood and lag screws per NFPA National Design Specification for Wood Construction; galvanized for exterior work.
- d. Washers: Malleable iron or standard cut steel.
- e. Powder Actuated Fasteners:
 - 1) Hilti, Inc.; type as shown, comparable products with current ICC approval and equal or greater rated load capacity, Ramset, or equal.
- G. Adhesive: Per APA-AFG-01 for Plywood Floor Sheathing.
- H. Building Paper: ASTM D226, 15 lb. asphalt saturated felt.
- I. Caulking: Provided under Division 7 – CALKING AND SEALANTS.

PART III - EXECUTION

3.01 PREPARATION

- A. Temporary Bracing: Provide bracing adequate to keep structure stable, plumb and in line; keep in place until permanent framing is completed. Provide bracing capable of supporting loads imposed by stockpiled material, erection equipment and other loads, during construction.

3.02 ERECTION

- A. General:
 - 1. Coordination: Coordinate placement of anchors, inserts, etc., in concrete and masonry. Establish locations, lines, levels and provide cutting, patching and fitting as required to accommodate built-in Work specified in other Sections.
 - 2. Lumber: Use new lumber; re-use not permitted unless authorized in writing by the University's Representative. Select lumber in a manner that allowable knots and obvious minor defects do not interfere with placement of bolts, nailing or structural connections.
 - 3. Layout: As shown; set plates, nailing blocks, anchors, grounds, etc., as required.
 - 4. Site Applied Wood Treatment: Brush apply two (2) coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts. Allow preservative to dry prior to erecting members.
 - 5. Fasteners:
 - a. Nails: Per CBC 2304.10.1, unless otherwise noted. Space groups of nails no closer together than $\frac{1}{2}$ nail length and not closer than $\frac{1}{4}$ nail length from cut ends of lumber. Prevent splitting due to nailing; drill

holes for nails where required to prevent splitting. Where nails of normal length may penetrate through exposed work, use nail of specified diameter and shorter length. Use of nailing gun is subject to written approval of the University's Representative.

- b. Bolts and Nuts: Use steel pieces as templates for location of holes; drill holes $\frac{1}{16}$ " larger than diameter of bolts; tighten nuts or rods and bolts at time of installation. Re-tighten before covering up and just before final acceptance of the work; at exposed work, cut protruding bolt ends off to within $\frac{1}{8}$ " of bolt head and file off all burrs.
- c. Washers: Install at bolts, nuts or lag screws bearing on wood; not required under heads of carriage bolts.
- d. Screws:
 - 1) General: Hammering or driving in place not permitted. Use soap to lubricate screw threads, if required.
 - 2) Lag Screws: Drill holes of same diameter and depth as shank; drill holes for threaded portion of screw no larger than $\frac{3}{4}$ shank diameter.
 - 3) Wood Screws: Drill lead holes for shank and threaded portions $\frac{7}{8}$ shank or thread root diameter.
- e. Powder Actuated Fasteners:
 - 1) General: Install where shown or required; DO NOT install in structural connections required to carry computed stresses.

B. Installation:

- 1. General:
 - a. Structural Members:
 - 1) General: Set level and plumb, in correct position; place horizontal members flat, with crown side up.
 - 2) Glue Laminated Beams: Provided under Division 6 – GLUE-LAMINATED BEAMS; do not erect until fabrication inspector's certificates have been reviewed by the University's Representative. Cutting is not permitted, except as shown on Drawings, or with written approval of the University's Representative.
 - b. Framing Members: Construct full length without splices.
 - c. Blocking:
 - 1) General: Provide as shown and where necessary to obtain required lines and levels in finished surface and to provide solid nailing. Secure blocking plumb and rigid; use wood shims

wherever necessary to form true and even plane for finish materials.

- 2) Firestopping: Provide per CBC at interior and exterior walls at intersection with floor, ceiling and roof, and at all hollow concealed spaces. Install minimum 2x material by width of enclosed spaces within partition in continuous row to prevent vertical and horizontal draft. Maximum concealed air space of 10'-0" in any direction.
- d. Recessed Fixtures: Frame openings for panel boxes and other equipment, as required for fixtures provided.
2. Floor Framing:
 - a. Sills: Secure with anchor bolts, [or nails,] as shown. Join solid sill at corners and with halved joints where member is not continuous.
 - b. Joist Framing: Support ends of each member with minimum of 1-½" bearing on structure below. Anchor joists and provide solid blocking for plywood joints, and as shown.
 - c. Plywood Subflooring: Set in adhesive; secure with long dimension perpendicular to joists, with joints located over joists and end joints staggered; nailing as shown.
3. Wall Framing:
 - a. General: Wood studs as shown; frame openings with multiple studs at sides and headers as shown.
 - b. Plates: Provide continuous sole plates and double top plates. Lap top plate splices 4'-0" minimum; lap at wall corners and intersections.
 - c. Studs: Continuous lengths without splices; provide solid blocking at plywood joints.
 - d. Framing for Piping: Provide proper clearances; furr partitions as required. At pipe 1-½" diameter, or less, set pipe in center of plate using neat holes; no notching allowed. Holes in plates less than 5-½" in width, not allowed.
 - e. Headers: Continuous members as shown.
 - f. Corner Bracing: Continuous members as shown.
 - g. Sheathing:
 - 1) General: Secure with long dimension perpendicular to studs, with joints located over studs or solid blocking and end joints staggered; nailing as shown.
 - 2) Plywood: Minimum 1/16" space at end joints and 1/8" at edge joints. Penetration of structurally required plywood to

accommodate electrical or mechanical requirements must be approved in writing by the University's Representative.

- 3) Gypsum Sheathing: As shown.
 - 4) Insulating Sheathing: Apply tongue and groove sheathing with long dimension horizontal.
4. Posts and Columns: As shown, straight, plumb and level; brace as required.
5. Roof Framing:
- a. General: Provide minimum 4" bearing at both ends of each member and anchor as shown. Provide solid blocking at plywood joints.
 - b. Beams and Girders: As shown; splices not permitted except where centered over columns.
 - c. Joist Framing: As shown.
 - d. Rafter Framing: Place rafters directly opposite each other at ridge; notch to fit exterior wall plates; bevel ends at ridge and hip. Provide double rafters at openings in roof.
 - e. Sheathing: Secure with long dimension perpendicular to studs, with joints located over studs or solid blocking and end joints staggered; nailing as shown. Minimum $\frac{1}{16}$ " space at end joints and $\frac{1}{8}$ " at edge joints.
6. Miscellaneous Framing:
- a. General: Provide nailers, backing, and stripping as necessary to obtain required lines and levels in finished surface. Secure plumb and rigid; use wood shims where required. Provide backing required for wall or ceiling hung fixtures and equipment.
 - b. Building Paper: Apply where shown, with 2" horizontal laps and 6" vertical laps at joints and corners. Use $\frac{3}{8}$ " head galvanized nails spaced adequately to hold paper in place, without buckling. Repair damaged paper before installation of finish material.
 - c. Caulking:
 - 1) General: Per Division 7 – CAULKING AND SEALANTS.
 - 2) Energy Compliance: Apply during framing operations as required by CBC.
 - 3) Sound-Rated Partitions: Install sole plates on double bead of acoustical sealant.
 - 4) Thresholds: Set in full bed, where shown.
 - d. Ventilating Holes: Provide in indicated sizes where shown.

- e. Mechanical and Electrical: Provide curbs, backing and blocking, as required for mechanical and electrical fixtures and equipment.
- C. Protection: Protect exposed roof sheathing and wood decking with protective waterproof covering until roofing has been installed.

END OF SECTION 06100

**SECTION 06410
CUSTOM CASEWORK**

PART I - GENERAL

1.01 DESCRIPTION

- A. Work of this Section shall include all materials and installation necessary to provide plastic covered casework, shelves, countertops, and accessories, as shown and detailed on the Drawings and specified herein.

1.02 RELATED WORK

- A. Division 5 – MISCELLANEOUS METAL FABRICATIONS
- B. Division 6 – FINISH CARPENTRY
- C. Division 9 – RESILIENT FLOORING
- D. Division 15 – MECHANICAL
- E. Division 16 – ELECTRICAL

1.03 QUALITY ASSURANCE

- A. All casework under this Section shall be the product of and supplied under the direction one manufacturer to eliminate incompatible items.
- B. The Drawings and Specifications outline the design intent and the general requirements of casework for the project. Construction details and specifications for casework are not complete, and casework furnished shall be completed for the intended use.
- C. The Drawings and Specification indicate requirements which may differ from manufacturer's standard product. Make all modifications necessary to comply with the requirements.
- D. Casework shall be designed, fabricated and installed to meet the quality standards established in the latest edition of "Manual of Millwork" of the Woodwork Institute of California (WIC).
- E. Manufacturer's Qualifications: If the manufacturer of casework is not a WIC licensee, the Contractor shall furnish to the University's Representative, prior to installation, a Certificate of Re-inspection by the WIC indicating that the casework in question meets the requirements of the WIC grade specified. If the manufacturer of casework is a WIC licensee, each unit run of casework shall bear the WIC Certified Compliance Label indicating the grade specified.

1.04 SUBMITTAL

- A. Procedures: In accordance with Division 1 Certification:
 - 1. Provide WIC Certified Compliance Label on each run of cabinet and countertop.
 - 2. Provide WIC Compliance Certificate.

3. Samples: Submit two (2) samples of the following:
 - a. Two (2) sets of cabinet hardware, including locks/latches, drawers pulls and hinges.
 - b. Two (2) sets of complete range of manufacturer's standard plastic laminate colors and textures.
 - c. Two (2) 6" x 6" sample of cabinet door with PVC edge banding for each type of plastic laminate with color(s) as selected for project.
 - d. Two (2) sets of 4" x 4" Decorative Synthetic Marble countertop of selected colors.
 - e. All samples will be retained to ensure that materials delivered to job site conform in every respect to accepted samples.
 - f. Samples may be used on the job once conformance to Drawings and Specifications have been confirmed.
- B. Shop Drawings: Submit shop drawings for each item of casework. Include plans, elevations, sections and details as required to illustrate shop fabrication field assembly and installation. Show size and locations of all cutouts. Identify all manufacturer's standard components with catalog numbers, and identify all materials and construction details of custom-fabricated items.
 1. WIC Certified Compliance Grade Stamp is required on all custom casework Shop Drawings.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver casework until all painting, finishing and overhead Work is complete in the spaces to receive casework.
- B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
- C. Store casework in a dry location of the building, out of the way of other construction activities.
- D. Handle casework with care so as not to damage surfaces or subject the cases to stress.

1.06 JOB CONDITIONS

- A. Coordinate with plumbing, mechanical, and electrical Work and University furnished equipment for proper sizing, location, and sequence of construction.
- B. All cutouts and holes for mechanical, plumbing and electrical Work shall be made at the project site.

PART II - PRODUCTS

2.01 MATERIALS

- A. General: All casework shall comply with Custom Grade, as defined by WIC, unless otherwise specified or shown on Drawings.
- B. Concealed Solid Lumber: Any species containing no defects which materially affect strength or utility of piece.
- C. Concealed Plywood: Any hardwood species containing no defects which materially affect strength or utility of piece. Front surfaces of back panels of casework shall be solid, melamine or equal.
- D. Plastic Laminate:
 - 1. Type: In conformance with NEMA publication LD3, latest edition, 0.028" thick minimum for all vertical surfaces and 0.04" thick minimum for countertops and other horizontal surfaces.
 - 2. Colors: As indicated in Building Interiors Color and Finish List.
- E. PVC Edge Band:
 - 1. 1 mm thick, colors to match adjacent surface on concealed shelves.
 - 2. 3 mm thick, colors to match adjacent surface on all cabinet doors, drawer fronts and false fronts.
- F. Decorative Synthetic Marble: Decorative Synthetic Marble will be bonded together using DuPont Adhesive except where not recommended by DuPont. Manufactured by E.I. Dupont de Nemours & Co., Inc. Wilmington De 19898, Nevamar, Avonite or equal.
 - 1. Colors: As indicated in Building Interiors Color and Finish List.
- G. Medium Density Fiberboard (MDF): Synthetic resin formed panel and compressed to a density of 50 pounds per cubic foot. Conform to ANSI A208.2-1980.
- H. Stainless Steel: Type 302, No. 4 satin finish.
- I. Plexiglass: ¼" thick, clear.
- J. Hardware: All hardware shall be in accordance with WIC standard except as specified below:
 - 1. Hinges: Heavy duty wrap-around hinges. Design to match specified numbers, self-closing, brushed chrome finish.
 - a. Provide 95% opening for cabinet door hinges adjacent to partition. Stanley HT1592, Rockford Process Control or equal.
 - b. Provide 175% opening for all other cabinet doors hinges. Stanley HT1592, Rockford Process Control or equal.

2. Door and Drawer Pulls: Extruded aluminum pull, EPCO MC-402-3.5, "European Look", 3-½" long, brushed chrome finish. Or equal, no known equal.
3. Drawer Slides: Full extension slides with minimum 125 pound capacity.
4. Lock: Manufacturer's standard lock. Brushed chrome finish.
5. Standard and Shelf Bracket:
 - a. Standard and Shelf Bracket for Cabinets: Steel standards with clip, recessed type for all cabinets, KV 255 or equal.
 - b. Standard and Bracket for Adjustable Shelves: Extra heavy-duty standards and brackets, steel, 7/8" wide x 1 1/16" high, 2" adjustment. Model No. 87-187 standard with #187LL bracket and #211 shelf rest by Knappe Vogt, or equal, no known equal.
6. Magnetic Catches: Heavy-duty magnetic catch with aluminum case for double door use as shown on Drawings.
7. Casters: 1-¼" diameter, 4 per cabinet; single ball bearing swivel plate casters with opaque non-marking white wheels; Bassick Model No. 56295SWBJ4 by Wilco Supply Company, Faultless or equal.
- K. Glazing: ¼" thick clear annealed glass, Type I, Class 1, quality q3 selected for optical use.
- L. Fasteners: In accordance with Division 5, METAL FABRICATIONS.
- M. Sealant: Silicone sealant in color to match color of surfaces applied.
- N. Grommet: 2-¼" diameter. Plastic, color to match countertop color.

2.02 FABRICATION

- A. General:
 1. Fabricate casework in accordance with WIC grades as specified below, and as shown on Drawings and approved Shop Drawings. Design Drawings and Specifications shall supersede the WIC Standards.
 - a. Grade: WIC Custom Grade for all casework in all areas unless otherwise specified.
 2. All units shall have easily cleanable flush interiors.
 3. Shop-fabricate casework in whole units or in partial units as most practical for handling and transportation. Assemble partial units in place in such manner that each piece of casework becomes a unified whole visually and structurally. Fabricate fillers and scribe strips of same material and finish as cabinet with which they are associated.
 4. Fabricate all casework with MDF or lumber core plywood. Use of particle board for casework, shall be rejected.

B. Base, Wall Hung, Full Height and Island Cabinets:

1. All cabinets shall be Style A, frameless, in accordance with WIC Standards, unless otherwise shown.
2. All exposed and semi-exposed surfaces shall be high-pressure plastic laminate finish, unless otherwise shown on Drawings and specified herein.
 - a. Provide high-pressure laminate cabinet liner for all cabinet surfaces when behind solid doors, except for shelving surfaces as specified.
 - b. Backs of doors and open shelf units will be considered exposed and shall match color of exposed portions.
3. Doors:
 - a. Swinging Doors: WIC Cabinet Door Type "A". 3 mm thick PVC Edge Banding on doors of medium density fiberboard construction (MDF) colors to match adjacent surfaces. Apply plastic laminate finish to both faces.
 - b. Modify WIC Cabinet Door Type "A" for installing glazing as specified in Paragraph 2.01 K. Size and location of glazing and cabinet door as shown in Drawings.
4. Adjustable Shelves: Plastic laminate over $\frac{3}{4}$ " MDF if span is less than 32", otherwise 1" MDF. Apply plastic laminate to all surfaces.
5. Provide seismic lip on front edge of all open shelves.
6. End Panel at Kneespace: Plastic laminate over 1" thick plywood core. Apply plastic laminate to all surfaces.

C. Countertops and Back Splashes:

1. Plastic Laminate Countertop and Back Splashes: Shall not be used around sinks or source of water. High pressure plastic laminate over $\frac{3}{4}$ " thick plywood core with 3" wide edge banding for a total edge thickness of 1- $\frac{1}{4}$ ", except as otherwise shown on Drawings and specified herein; $\frac{1}{4}$ " coved radius at intersection of countertop and backsplash. Other edges as shown. Apply plastic laminate to all surfaces.
2. Decorative Synthetic Marble Countertops and Back Splashes: This material to be used around sinks or whenever there is a source of water. Countertops and back splashes shall be formed in one piece. Minimum thickness $\frac{3}{4}$ " with bonded lip, or $\frac{1}{2}$ " if supported per DuPont standards. Provide $\frac{1}{4}$ " coved radius at countertop to backsplash. Countertops that are cast flat shall have a uniform low-sheen surface and be resistant to scratches and abrasion. Profile as shown.
 - a. Provide sink cutouts as indicated in Drawings and as recommended by sink manufacturer.
 - b. Provide Decorative Synthetic Marble countertops and backsplashes as indicated in Drawings.

3. All countertops shall have 1" overhang on front and $\frac{1}{2}$ " overhang on exposed sides unless otherwise shown.
 4. Ends of splashes shall be closed, and the spaces between partitions and splashes at junctions shall be sealed with sealant.
 5. Provide plastic grommet for all utility cut out at countertops and as shown.
- D. Adjustable Shelves: Plastic laminate finish over $\frac{3}{4}$ " thick MDF. Apply plastic laminate to all surfaces. Notch bottom of shelf for brackets
1. Provide seismic lip for all adjustable shelves.
 2. Standards and Brackets: Install standards at 32" on center maximum. Length of brackets as required for shelf width. Standards to be attached to studs or backing with #8 flat head tapping screws, utilizing all mounting holes.
- E. Glass Drying Racks: Stainless steel, manufacturers' items. Mod Rack, or equal, no known equal. Model numbers are as manufactured by Mod Rack and are used to establish a standard of quality and appearance.
1. Model No. V1824 by Mod Rack, 1'-6" (W) x 2'-0" (H) with drip-stop trough DT-18 and screen insert SI-18.
- F. Keying: Provide two keyway cores for each lock. All locks shall be keyed by the UCDCM Key Shop.

PART III - EXECUTION

3.01 EXAMINATION

- A. Accurately fit all casework and components.
- B. Verify that surfaces and spaces to receive casework are satisfactory for installation. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected.
- C. Prior to installation of casework, examine shop-fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

- A. Install casework under the direct supervision of the casework manufacturer.
- B. Install casework straight, plumb level and true with no distortions. Shim as required using concealed shims. Where casework abuts other finished work, scribe and apply filler strips for accurate fit with all fasteners concealed where practicable.
- C. Secure base cabinet to floor at toe space with fasteners spaced 24" on center, unless otherwise shown on Drawings, and bolt contiguous cabinets together. Secure individual cabinets with not less than two fasteners into floor where they do not adjoin other cabinet.
 1. Where required, assemble units into one integral unit with joint flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of $\frac{1}{16}$ ".

2. Base cabinets shall be installed so that any one cabinet within a row can be removed or installed without disturbing adjoining cabinets.
 3. Provide holes and cutouts for mechanical, plumbing and electrical work as necessary to coordinate with other work. Provide stainless steel escutcheons for all utilities through cabinets.
- D. Secure all wall hung cabinets to backing plates as shown and scheduled. Anchor, adjust, and align wall hung cabinets as specified for base cabinets.
- E. Provide fillers and scribe strips so that cabinet fronts, and sides present a finished and unbroken surface to adjacent cabinet units or partitions. Cut scribe strips so that no gap greater than $\frac{1}{16}$ " exists where casework is fitted against flat or irregular surfaces.
- F. At open shelves, install steel standards at three foot on center maximum.
- G. Install Decorative Synthetic Marble countertops and backsplashes plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and manufacturer's instructions.
1. Form inconspicuous joints in finished work.
 2. Adhere countertops and backsplashes using manufacturer's standard color-matched silicone sealant.

3.03 CLEANING AND PROTECTION

- A. Following completion of installation, clean surfaces of casework, and clean and polish hardware, in conformance with manufacturer's recommendations.

END OF SECTION 06410

SECTION 07264
WATER VAPOR EMISSION CONTROL BARRIER

PART I - GENERAL

1.01 DESCRIPTION

- A. Work under this Section includes, but is not necessarily limited to vapor control barrier.
- B. Related Sections include the following:
 - 1. Division 3, Section 03300 – Cast-in-Place Concrete
 - 2. Division 9 – FINISHES

1.02 SYSTEM DESCRIPTION

- A. Provide a moisture vapor control system consisting of a combination of epoxy resins and other chemical compounds that is specifically formulated to prevent floor failures on concrete slabs. The moisture mitigation system must comply with the full intent of the newly adopted ASTM F3010-13 standard. A signed “Certificate of Conformance” must be presented to the University stating that the product submitted complies with this ASTM standard.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Membrane-forming moisture mitigation systems to be qualified under this practice shall have a vapor permeance no greater than $0.1 \text{ grains h}^{-1} \text{ ft}^{-2} \text{ in. Hg}^{-1}$ when tested in accordance with Test Method E96 Wet Method when applied at the recommended thickness designated by its manufacturer.
- B. Applicator: Must be “Certified” with the product manufacturer as being trained and qualified to apply the specified product.

1.04 SUBMITTALS

- A. GENERAL: Refer to Section 01330 – Shop Drawings, Product Data and Samples.
- B. PRODUCT DATA: Manufacturer’s specification, data, and installation instructions.
- C. Submit installer “certificate” from the product manufacturer.
- D. Submit Tests from an Independent Testing Agency for the following: Testing Agency must be certified by the International Concrete Repair Institute (ICRI).
 - 1. ASTM E 96 Test Methods for water Vapor Transmission of materials, Wet Method - vapor permeance no greater than $0.1 \text{ grains h}^{-1} \text{ ft}^{-2} \text{ in. Hg}^{-1}$
 - 2. ASTM D 7234 Test Method for Pull-Off Adhesion Strength of Coatings on concrete using portable Pull-Off Adhesion Testers
 - 3. ASTM F 2170 Test Method for Determining Relative Humidity in concrete floor slabs using Insitu Probes manufactured by Wagner Electronics.

4. ASTM F-3010-13 – Submit signed “Certificate of Conformance” document confirming product submitted meets or exceeds the full intent of this standard.
5. ASTM F 710 – Test Method to Measure PH levels of the concrete using an Electronic PH Meter manufactured by Wagner Electronics.

E. Warranty certificate as specified.

1.05 PRODUCT HANDLING

- A. Refer to Section 01610 – Product Requirements.
- B. Material data safety sheet to be delivered to site prior to application.

1.06 JOB CONDITIONS

- A. Concrete surface temperature shall be 50 to 90°F.

1.07 WARRANTY

- A. 15 year warranty if product is applied by a trained and manufacturer approved installer.
 1. Warranty; Beginning on the date the project was finished the specified product manufacturer will warrant the system against material defects and the vapor transmission reduction as shown in the manufacturer printed literature is subject to the condition and restrictions set forth in the warranty.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Specified Product: KOSTER VAP 1 2000 or Equal
 1. 100% solid 2 component epoxy barrier system used for the control of moisture vapor emission and alkalinity control. Product must have an overall perm rating of 0.1 or less.
 2. No water based or silicates formulation allowed.
 3. Be assured self leveling products and adhesives comply with the specified product.

2.02 PHYSICAL PROPERTIES

- A. Formulation: Moisture vapor control system consisting of a combination of epoxy resins and other chemical compounds. No Water based or silicate formulation allowed.
- B. The methods below are to be conducted by an Independent Laboratory testing certified by ICRI: See 1.04 Submittals
 1. ASTM E 96 Water Vapor Transmission, wet method. Vapor permeance no greater than 0.1 grains h⁻¹ ft⁻² in. Hg⁻¹
 2. ASTM D 7234 Concrete Adhesion Min 500 psi (100% concrete cohesive failure)

3. ASTM D 1308 Chemical Resistance, 14pH solution No damage, 100% resistant at 28 day exposure
4. ASTM F 710 – Test Method to Measure PH levels of the concrete.

PART III - EXECUTION

3.01 EXAMINATION

- A. New Interior Concrete Substrates;
 1. Submit the mix design of the new concrete to be coated to the manufacturer technical team for review to identify possible bonding issues that may be inherent. Identify how the concrete was cured and what compounds if any were used and to submit to the manufacturer. No silicates may be added to the concrete or spray applied.
- B. Existing Interior Concrete Substrates with existing floor failures;
 1. University might choose to take cores of older existing slabs and have them analyzed by a qualified laboratory. Discuss the details of the findings with the manufacturer's technical team and the University Representative. (Consultant to omit if the University chooses not to take core samples)

3.02 INSTALLATION

- A. Mechanically prepare surfaces to an ICRI #3 by shotblasting. Grinding is permitted in inaccessible areas or for edging purposes.
 1. Mix and apply the control barrier system in accordance with the manufacturers written instructions.
 2. Treat all moving, non-moving voids and cracks in accordance with the manufacturers written instructions.

3.03 FIELD QUALITY CONTROL

- A. Floor Covering Applications
 1. Post installation moisture test not required after the installation or product.
 2. Disposal of product should be done in accordance with current local, state and federal regulations.

END OF SECTION 07264

SECTION 07920 CAULKING AND SEALANTS

PART I - GENERAL

1.01 DESCRIPTION:

- A. Scope: Work of this Section shall include all materials and installation necessary to provide Caulking and Sealants, as shown and detailed on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. References:

- 1. Sealant, Waterproofing and Restoration Institute (SWRI): Sealant and Caulking Guide Specification.

B. QUALIFICATIONS:

- 1. General: The manufacturer of the sealant used shall have been in the business of manufacturing the specified types of such sealants for not less than ten (10) years.
- 2. Applicator: Installer specializing in the work of this Section with minimum five (5) years documented experience
- 3. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by Federal and State EPA regulations.

- C. Compatibility With Substrate: Verify that caulking and sealants used are compatible with joint materials.

- D. Joint Tolerances: Comply with manufacturer's joint width/depth ratio limitations.

1.03 SUBMITTALS

- A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Submit manufacturer's standard colors prior to application.
- C. Product Data: Submit manufacturer's specifications, data, and installation instructions for review prior to purchase or application.
- D. Certificates: Submit certification that sealants proposed for use, comply with the Contract Documents.

1.04 PRODUCT HANDLING

- A. General: Refer to Section 01310 – COORDINATION.

- B. Storage: Per manufacturer's recommendations for proper precautions for shelf life, temperature, humidity and similar storage factors to ensure the fitness of the material when installed.

1.05 SITE CONDITIONS

- A. Environmental Requirements: Do not apply materials when temperature is below 40°F, nor under extreme temperature conditions when joint openings are at maximum or minimum width.

1.06 MAINTENANCE

- A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES.
- B. Guarantee: On form provided at end of Section 01780 – CLOSE OUT SUBMITTALS, provide five (5) year written guarantee commencing from date of final acceptance by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

- A. Caulking And Sealants:
 - 1. Manufactured by Tremco, Inc., unless otherwise noted.
 - 2. Pecora Chemical Corp. or equal.
 - 3. Color to be selected by University's Representative.
- B. Exterior Joints:
 - 1. Vertical Surfaces: Non-sag polyurethane; by Dymeric or equal.
 - 2. Precompressed Expanding Sealant Tape:
 - a. PC-SA manufactured by Emseal Joint Systems, Ltd.
 - b. Pecora Chemical Corp. or equal.
 - 3. Horizontal Paving Joints: Self-leveling polyurethane; THC 900; interior and exterior.
- C. Interior Joints: Acrylic Latex.
- D. Joint Cleaner: Provide cleaner recommended by sealant manufacturer for specific joint surface and condition.
- E. Joint Primer and Sealer: As recommended by sealant manufacturer for each condition.
- F. Bond Breaker Tape: Pressure sensitive polyethylene tape.
- G. Other Materials: Manufacturer's standard for items required or type best suited for intended use.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Section 01310 – COORDINATION.
- B. Conditions Of Work In Place:
 - 1. General: Carefully examine before beginning work; report defects.
 - 2. Substrate: Inspect surfaces to insure that no bond-breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired.
- C. Preparation Of Surfaces:
 - 1. Surfaces: Prepare joints in accordance with manufacturer's recommended instruction to ensure maximum adhesion. Prime as required, protecting adjacent exposed surfaces.
 - 2. Sealants: Prepare sealant as required, including proper mixing of multicomponent sealants.

3.02 APPLICATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Protection: Protect surfaces adjacent to joints to receive sealant. Cover joints in walking surfaces with heavy duty, non-staining tape, until material has dried.
- C. Installation:
 - 1. General: Install sealant materials per manufacturer's instructions. Prevent three-sided adhesion. Provide sealant depth of $\frac{1}{2}$ joint width; minimum depth of $\frac{1}{4}$ "; maximum of $\frac{1}{2}$ ", unless otherwise required by the manufacturer.
 - 2. Backer Rod: Install using blunt or rounded tools to insure uniform ($\pm\frac{1}{8}$ ") depth without puncturing material. Use oversize backer rod; minimum of 33% for closed cell type; minimum of 50% for open cell type, unless otherwise required by the manufacturer.

3.03 CLEANING

- A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions. Perform cleaning in a manner that will not affect the appearance of the sealant or the adjacent finish material.

END OF SECTION 07920

**SECTION 08100
HOLLOW METAL DOORS AND FRAMES**

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all material and installation necessary to provide Hollow Metal Doors and Frames, as shown and detailed on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. Labeled Doors And Frames: Conform to requirements of State Fire Marshal Standard 12-43-4 and Underwriters Laboratory. Provide label information required by Section 12-43-407, Part 12, T-24 CCR.
- B. Design Requirements: Exterior glazed frame members designed to withstand a wind load of 24 lbs. per square foot, minimum.
- C. Reference Standards:
 - 1. Handicapped Requirements:
 - a. General: Comply with requirements of the Americans with Disabilities Act.
 - b. American National Standards Institute (ANSI): ANSI A117.1: Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. Steel Door Institute (SDI): ANSI/SDI-100.
 - 3. Door Hardware Institute (DHI): Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
 - 4. National Fire Protection Association (NFPA):
 - a. NFPA 80: Fire Doors and Windows.
 - b. NFPA 252: Fire Tests for Door Assemblies.
 - 5. Underwriters Laboratories (UL): UL 10B, Fire Tests for Door Assemblies.

1.03 SUBMITTALS

- A. Shop Drawings: Submit manufacture and installation details, including fastenings, for review. Show details of each condition at 3" scale.
- B. Samples: If specifically requested.
- C. Product Data: Submit manufacturer's specification, data, and installation instructions for review.

PART II - PRODUCTS

2.01 MATERIALS

- A. Steel:
 - 1. Sheet: ASTM A366 (CR) and A569 (HR), uncoated, pickled, and free from pits and defects. Use cold-rolled or hot-rolled for frames; stretcher-leveled for 18 gauge and lighter.
 - 2. Reinforcement: ASTM A36.
- B. Fasteners: Galvanized or cadmium plated.
 - 1. Bolts and Nuts: ASTM A307, Grade A.
 - 2. Machine Screws: FS FF-S-92, Type III cross-recessed, Design I or II recess, Style 2c flat head; carbon steel.
 - 3. Sound Deadening: Fibered asphalt emulsion.
- C. Silencers: Resilient rubber; manufacturer's standard.
- D. Sealant: Refer to Division 7, Section 07920 – Caulking and Sealants.

2.02 MANUFACTURE

- A. Hardware Requirements: Prepare doors and frames at factory to receive template hardware per final schedule; locate as specified under Division 8, Section 08710 – Finish Hardware. Provide reinforcements of specified thicknesses and sizes recommended by hardware manufacturer; hinge reinforcements not less than 7 gauge and at least 9" long; other mortised and countersunk items not less than 12 gauge; surface applied items not less than 14 gauge.
- B. Hollow Metal Doors:
 - 1. General:
 - a. Exterior (Non-thermally Broken): SDI-100 Grade II, Model 1.
 - b. Exterior (Thermally Broken): SDI-100 Grade II, Model 2.
 - c. Interior (Non-rated): SDI-100 Grade II, Model 1.
 - d. Interior (Fire Rated): SDI-100 Grade II, Model 2.
 - e. Interior (Acoustic): SDI-100 Grade II, Model 2.
 - 2. Door Construction:
 - a. Face: Steel sheet in accordance with ANSI/SDI-100.
 - b. Core:
 - 1) General: Manufacturer's standard for following uses.

- 2) Composite: For Fire rating, as shown.
 - 3) Thermal Insulated: Total insulation R value of 11, measured in accordance with ASTM C236.
 - 4) Sound Rated: STC of 50, measured in accordance with ASTM E413.
3. Accessories:
- a. Louvers: Model No. AFDL.
 - b. Vision Light Frames: Model No. BFL-75; glass and glazing per Division 8 "Glass and Glazing" as shown.
 - c. Fasteners: Manufacturer's standard; tamperproof.
4. Astragals: $\frac{1}{8}$ " x 2" steel, as shown, specifically for double doors. Secure with tamperproof bolts at 6" on center and 1" from each end.
- C. Metal Frames:
1. Exterior: 16 gauge; 14 gauge for frames over 3'-0" wide.
 2. Interior Frames: 16 gauge; 14 gauge for frames over 3'-0" wide or fire rated.
- D. Finish: Baked primer Factory baked enamel; color as selected by the University's Representative.

2.03 FABRICATION

- A. Metal Doors:
1. Types:
 - a. Flush Doors: Fabricate doors with hardware reinforcement welded in place. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
 - b. Stile and Rail Doors: Provide where shown with internal continuous channel reinforcement; furnish plain square-type removable glazing beads secured to frame with countersunk screws spaced not more than 12" on center.
 - c. Dutch Doors: Fabricate as specified for flush doors. Provide shelf with boxed edges and closed ends; fabricate from 16 gauge galvanized steel sheet. Support shelf on door manufacturer's standard steel brackets, unless otherwise shown.
 - d. Flush Panels: Fabricate as specified for flush doors. Prepare panels for concealed support and anchorage.
 2. Fire Rated Doors: Permanently attach fire-rating label to each door unit.
 3. Glazed and Louvered Openings: As shown.

4. Door Clearances: Provide $\frac{1}{8}$ " maximum clearance at jambs, heads, and meeting stiles; threshold clearances as specified under Division 8 "Finish Hardware".
5. Electrical Requirements: Make provisions for installation of electrical items specified in Division 8 "Finish Hardware" and other applicable Sections.

B. Metal Frames:

1. Type:
 - a. Standard Frames: Fabricate frames as welded unit.
 - b. Knock Down Frames: For field assembly.
 - c. Drywall Frames: Drywall slip-on type.
2. Fire Rated Frames: Fabricate as specified for standard metal frames permanently attach fire-rating label to frame.
3. Glazed Lights:
 - a. General: As shown; provide applied stops as required.
 - b. Transom Bars: Fixed type, of same profiles as jamb and head.
4. Reinforcement:
 - a. General: Reinforce frames wider than 48" with roll-formed steel channels fitted tightly into frame head, flush with top.
 - b. Hardware: Fabricate frames with reinforcing plates welded in place. Provide mortar guard boxes, where required.
5. Stops:
 - a. Applied Stops: Rolled steel shape, mitered corners, prepared for countersink style tamper proof screws. Provide replaceable closed-cell sponge neoprene gasket, thickness as recommended by manufacturer.
 - b. Hospital Type: Terminate doorstops 6" above finished floor. Cut stop at 45° angle and close.
6. Mullions for Double Doors: Fixed type, of same profiles as jambs.
7. Silencers:
 - a. Single Doors and Mullions of Double Doors: Provide three (3) single silencers equally spaced on strike side.
 - b. Frame Head at Double Doors without Mullions: Provide two (2) single silencers equally spaced.
8. Sound Deadening: Coat inside (concealed) faces of doorframes in hollow wall construction. Apply emulsion over shop primer $\frac{1}{8}$ " thick and dry thoroughly before handling.

- C. Anchors:
1. General: Fabricate 16 gauge x 2" wide anchors of same material used for door frames.
 2. Wood Stud Partitions: Wood stud anchors with perforations.
 3. Metal Stud Partitions: Metal stud type anchors.
 4. Masonry: Tee shaped anchors at least 10" long, corrugated or perforated; adjustable type.
 5. Concrete: Tee shaped anchors at least 10" long, corrugated or perforated.
 6. Solid Plaster Partitions: Provide adjustable steel top strut anchors on each side of frame for fastening to structure above, as recommended by the manufacturer.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Division 1, Section 01310 – Coordination. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. General: Install in strict conformance with referenced standards, the manufacturer's written directions, as shown, and as herein specified.
- B. Fire Rated Openings: As shown; make manufacturer's installation instructions available to inspecting authorities.
- C. Anchors:
1. Jambs:
 - a. General: Position one (1) anchor above top butt reinforcement and one (1) anchor below bottom butt reinforcement; minimum four (4) anchors per doorjamb, 24" on center maximum.
 - b. Frames Set in Wood Stud Partitions: Weld anchors to frames; secure to wood studs with two (2) fasteners per anchor. Use two (2) No. 12 x 2-½" flathead screws, or two (2) 12d nails (wire anchors not acceptable).
 - c. Frames Set in Metal Stud Partitions:
 - 1) General: Weld to frames and studs.
 - 2) 25 gauge Studs: Fasten to studs with sheet metal screws per anchor manufacturer's recommendations.
 - d. Frames Set in Masonry: Friction fit to frames.
 - e. Frames Set in Concrete: Weld to frames.

- f. Frames Set in Previously Placed Concrete or Masonry: Unless otherwise shown, anchor frames with ¼" diameter expansion bolts; space not more than 24" on center, nor with less than four (4) anchors per jamb.
 - g. Frames Set in Solid Plaster Partitions: Fasten strut anchors to concrete with two ¼" diameter expansion bolts and to steel with two (2) welds per anchor.
 - 2. Head: Provide minimum of two (2) anchors at frames over 2'-6" wide; 24" on center, maximum.
 - D. Metal Frames:
 - 1. General: Set frames plumb, straight and square; align and securely brace until permanent anchors are set; use shims where required. Remove temporary braces after wall construction is completed.
 - 2. Door Frames:
 - a. Standard Frames: Where shown, provide overhead frame bracing; securely anchor to structure. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
 - b. Knock Down Frames: As shown; per manufacturer's instructions.
 - c. Drywall Frames: As shown; per manufacturer's instructions.
 - 3. Glazed Frames: Attach frames to structure to withstand 24 lbs. per square foot wind load normal to glass surface. Coordinate installation of glazing per Division 8, Section 08810 – Glass and Glazing.
 - 4. Sealant: Seal perimeter of frames and adjoining material per Division 7, Section 07920 – Caulking and Sealants.
 - E. Metal Doors:
 - 1. General: Match doors into their respective frames; install plumb, straight and square.
 - 2. Glazed Lights: Coordinate installation of glazing per Division 8, Section 08810 – Glass and Glazing.
 - 3. Door Louvers: As shown.
 - 4. Hardware: Per Division 8, Section 08710 – Finish Hardware.
 - 5. Maximum Diagonal Distortion: ⅛" measured with straight-edge, corner to corner.
 - F. Finish: Touch-up factory applied finish.

3.03 ADJUSTMENTS

- A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

3.04 CLEANING

- A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 08100

SECTION 08310 ACCESS DOORS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Access Doors as shown and detailed on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. National Fire Protection Association (NFPA): Fire tests.
 - 2. Underwriters Laboratories (UL): Fire tests.

PART II - PRODUCTS

2.01 MATERIALS

- A. Access Doors:
 - 1. Steel frame with continuous hinge, manufactured by Milcor, Inc.; sizes as shown, J.L. Industries, or equal.
- B. Walls:
 - 1. Gypsum Wallboard: Style M, with standard cam lock.
 - 2. Plaster: Style K, with standard cam lock.
- C. Ceilings:
 - 1. Acoustical Tile: Style AT, with flush cam lock.
 - 2. Plaster: Style AP, with integral lath for plastering and flush cam lock.
- D. Fire Rated Openings:
 - 1. General: "Fire Rated" type with flush face key operated mortise cylinder lock and interior latch release mechanism; UL rating of 1-½ hours; "B" label.
 - 2. Wall: Model No. 3208.
 - 3. Ceiling: Model No. 3210.
 - 4. Security Door: Model No. 3211.
- E. Fasteners: As recommended by manufacturer.
- F. Primer: Rust inhibiting.

PART III - EXECUTION

3.01 PREPARATION

- A. Measurements General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. General: Take field measurements; report variance between plan and field dimensions.

3.02 ADJUSTMENT

- A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

3.03 CLEANING

- A. Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 08310

SECTION 08710 FINISH HARDWARE

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Finish Hardware as shown and detailed on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. References:
1. General: Satisfy current applicable fire, building and accessibility codes and rules.
 2. Accessibility Standards:
 - a. General: ANSI A117.1 and the California Building Code section 11-B
 - b. Americans with Disabilities Act (ADA): Standards
 3. National Fire Protection Association (NFPA): NFPA 80, 101, and 252
 4. American Woodwork Institute (AWI): Quality Standards
 5. Underwriters Laboratories: UL 10B and 305

1.03 QUALIFICATIONS:

- A. Supplier:
1. General: A firm specializing in the supply and servicing of institutional and commercial door hardware for at least five (5) years.

1.04 SUBMITTALS

- A. Hardware Schedule:
1. General: Submit completely detailed finish hardware schedule in vertical format. Reference headings to hardware groups specified and clearly indicate door type, or mark, describe its location, hand, size, door and frame material, and fire rating, if applicable. Organize all doors with the exact same hardware group under one heading, either per building, or per project. If per project, list doors per building in numerical order.
 2. Non-Acceptance: Coded, or keyed hardware scheduling, creating a separate heading for every door and requiring reference to master lists of products is not acceptable, and will be rejected without review.

B. Manufacturers List:

1. General: List manufacturer's names and product numbers for items used in hardware schedule to facilitate checking for compliance.
2. Product Source: Furnish each type of lock and latchset from a single manufacturer, unless more than one manufacturer's products are specified
3. Substitutions: Refer to Division 1, Section 01610 – Product Requirements. If substitutions are offered, list both the specified product and the proposed substitution.
 - a. Samples:
 - 1) General: Submit, with hardware schedule, physical sample of each item proposed to be substituted for specified item.
 - 2) Label: Clearly mark each sample to indicate name of item, brand name, manufacturer's catalog number and item for which it is proposed to be substituted.
 - 3) Disposition: Approved samples may be used in work; rejected samples will be returned.

1.05 PRODUCT HANDLING

- A. General: Refer to Division 1, Section 01310 – Coordination.
- B. Packaging: Mark all materials so as to identify door number, hardware type, location and hand of door
- C. Keys: Label and deliver all keys to University's Representative.
- D. Coordination:
 1. General: Hardware applied to aluminum or metal doors and frames and factory prepared wood doors and frames shall be made to template; provide two copies of approved finish hardware schedule for use by door and frame suppliers.
 2. Distribution: Furnish two copies of each template to those manufacturers who are not listed as current registered template book holders; furnish two copies of each template for items whose manufacturers do not provide registered template book.

1.06 MAINTENANCE

- A. Guarantee:
 1. General: Provide in required form for a period of one (1) year from date of final acceptance by University.
 2. Door Closers: Twenty-five (25) years.
 3. Exit Devices: Five (5) years.

PART II - PRODUCTS

2.01 MATERIALS

- A. SPECIFIED PRODUCTS AND ACCEPTABLE MANUFACTURERS Catalog numbers used below are those of the following specified manufacturers. Acceptable alternate manufacturers are as listed; items produced by acceptable manufacturers, comparable to those specified in material, weight, size, function, design and finish will be considered accepted equals to those items specified and will not require submittal of physical sample or request for substitution. Any other manufacturers other than those listed as "Specified" or "Acceptable Manufacturer" will be considered as "or equal" subject to requirements for substitution requests or required by Division 1. University's Representative's decision regarding any item submitted for approval as equal to that specified shall be final.

Product	Specified	Acceptable Manufacturers
Hinges	Hagar	Stanley; Ives
Special control hinges	Rockford Process	No known equal
Interior Doors (Locks & Cylinders)	Schlage "ND" series	No known equal
Exterior Doors (Locks & Cylinders)	Schlage Primus L series	No known equal
Closers	LCN 4040	Dorma; Yale
Floor/Wall Stops	Glynn Johnson	Brass; Quality
Exit Devices	Von Duprin	No known equal
Astragals	Pemco	National Guard; Zero
Thresholds and Weatherstrip	Pemco	National Guard; Zero
Silencers	Brass	Quality; Signature
Trim	Signature Brass	Door Controls Int'l; Quality
Overhead Stops and Holders	Glynn-Johnson	Rixon; Sargent
Flush Bolt Coordinators	Ives	No known equal
Electronic Strikes	Von Duprin 6100/6300 series	No known equal
Electronic Locksets	Schlage L9080 series/ND 96 series	No known equal
Electromagnet Holders	LCN	Rixon
Electromagnet Locks	SDE	Locknetics
Bifold Hardware	Grant	Haefele; L.E. Johnson
Key Cabinet	Door Controls Intl.	H.B.Ives; Telkee; Lund; Key Control Systems, Inc.

Key Cabinet:

B. Manufactured Units:

1. Locks:
 - a. General: Provide wrought boxes for strikes.
 - b. Keys: Furnish three (3) uncut blanks for each lockset, in keyways to match project system.
2. Closers: Key valve type or screw type; furnish one key for each five (5) closers. Fasten with four (4) sex bolts per closer. Provide 180° opening where indicated. Provide parallel arms with jamb attachment for all out-swinging doors. Supply drop plates at narrow top rail doors, as required.

3. Screws, Bolts, and Fastening Devices: Exposed head oval Phillips type in countersunk holes, unless otherwise specified or required. Use screws, bolts, washers, grommets, nuts, and other fastening devices of appropriate length, type, head, metal and finish, as necessary for proper match and application of hardware. See Division 5, Section 05500 – Miscellaneous Metal Fabrications.
4. Fire Rated Doors: Equip fire rated doors with UL listed hardware meeting requirements of CBC Chapter 43 and Fire Protection Equipment list of Underwriters Laboratories, Inc.
5. Padlock: Schlage PL4741 padlock or equal keyed as directed for roof hatches, gates, traffic barrier bollards and roof access ladder security covers.
6. Thresholds: Provide all thresholds, door bottoms and seals as specified, or detailed. Provide thresholds with non-standard custom-drilled screw holes where details indicate this requirement.
7. Butt Hinges:
 - a. General Locking reverse bevel doors shall be furnished with NRP feature butts. All doors with closers shall be furnished with ball, or oilite bearing butts.
 - b. Exterior: Butts for reverse bevel exterior doors shall be of equivalent model listed, but shall be of nonferrous metal.
 - c. Size: Unless otherwise specified, the size of the butts will be determined by the following rules:
 - 1) Doors 1- $\frac{3}{8}$ " thick and up to 2'-4" wide: 3- $\frac{1}{2}$ " butts.
 - 2) Doors 1- $\frac{3}{8}$ " inch thick over 2'-4" to 3'-0" Wide: 4" butts.
 - 3) Doors 1- $\frac{3}{4}$ " thick up to 3'-0" wide: 4- $\frac{1}{2}$ " butts.
 - 4) Doors 1- $\frac{3}{4}$ " thick over 3'-0" wide: 5" butts.
 - 5) Note: All butts shall be of proper width to clear trim in projection to allow 180° swing and that width shall be determined by the following rules:
 - 6) For doors up to 2- $\frac{1}{4}$ " thick: twice the door thickness, plus trim projection, less $\frac{1}{2}$ ", equals the proper hinge width. For doors 2- $\frac{1}{4}$ " to 3" thick: twice the door thickness, plus trim projection, less $\frac{3}{4}$ " equals the proper hinge width. Furnish three butts for each door leaf up to 7'-0" high. Furnish an additional butt for each 2'-0" of door height over 7'-0".

2.02 KEYING

- A. General: All keyed locks shall have temporary cylinders or plugs during construction. Provide following:
 1. Grand Master Key System:

- a. General: Key to University's existing Primus Controlled Access Grand Master Key System; provide six (6) cut GMK and six (6) cut Master Keys per set; allow for four (4) Master Key sets.
 - b. Keying: All final keying to be performed by UCDCM Lock Shop. Deliver interior and exterior cylinders to University's Representative for final re-keying.
2. Key Control System: Visual; stamp keys with key set symbols.
 3. Construction Master Key System: Furnish twenty (20) construction master keys, and four (4) extractor keys.
 4. Change Keys: Three (3) standard bow change keys per cylinder.

2.03 FINISHES

- A. General: Provide finishes as follows, unless otherwise indicated:

Hinges:	Exterior 630 (32D);
Interior	652 (26D)
Locks:	626 (26D)
Closers:	689 (Aluminum finish)
Floor Closers:	626 (26D)
Stops:	626 (26D)
Exit Devices:	626 (26D)
Thresholds/Weatherstripping:	628 (28)
Trim:	626 (26D)
Protection Plates:	63G (32D)
Special Items:	As Noted
Key Cabinet:	Manufacturer's standard

PART III - EXECUTION

3.01 APPLICATION

- A. General: Install in strict conformance with referenced standards, the manufacturer's written directions, as shown, and as herein specified.
- B. Floor Clearances: Unless detailed otherwise on Drawings, provide following clearances:
1. Labeled Doors: $\frac{3}{8}$ " maximum over floor or threshold.
 2. No Threshold: $\frac{3}{4}$ " maximum for metal doors; $\frac{5}{8}$ " maximum for wood doors.
 3. Threshold: $\frac{1}{8}$ " typical.
 4. Carpet: $\frac{1}{8}$ " over top of nap, unless otherwise shown.
- C. Hardware Placement: Except for hinges, do not install hardware until completion of painting and finishing work. Unless detailed otherwise, place hardware at following height above finish floor:
1. Strike (Centerline) for Locks and Latches: Between 40" and 42".

2. Hinges: Manufacturer's standard.
3. Door Pull (Centerline): 42".
4. Push Plate (Centerline): 44".
5. Deadlocks (Centerline of Cylinder): 44".

D. Installation:

1. General: Install hardware in precise manner; door clearance and hardware placement as specified. Predrill pilot holes in wood for screws. Drill and tap for surface mounted hardware on metal.
2. Hinges: Set hinge leaves snug and flat in mortises; turn screws to flat seat (do not drive). Drive hinge pins down and tighten setscrews.
3. Closers: Mount door closers for maximum swing of door before setting stops.
4. Silencers: Set in place before adjusting strikes.
5. Locksets: Install locks with keyways in proper position, and levers, roses and escutcheons firmly affixed.
6. Thresholds: Set in waterproof sealant and secure with lead shields and countersunk screws of same finish as threshold. In heavy traffic areas use Hilti Countersunk Kwik Bolt II, size dependant on height of threshold, or equal.

E. Reinstallation Of Existing Doors:

1. General: Remove existing doors noted to have swing reversed, alter door and hardware as required, and reinstall door with new swing as indicated.
2. Hardware: Provide new hardware where existing cannot be altered to suit new conditions. New hardware, when required, of quality specified herein and function to match that of existing door.

3.02 ADJUSTMENT AND MAINTENANCE

- A. General: Prior to acceptance, adjust all moveable parts to assure smooth operation.
- B. Door Closers: Adjust for closing speed, latching speed, back checking, and adjust hold-open devices for full control of door. Maximum effort to operate doors shall not exceed 5.0 lbs. for exterior doors, 5.0 lbs. for interior doors, and 15 lbs. for fire doors.

3.03 CLEANING

- A. General: Upon completion, thoroughly clean all exposed surfaces per manufacturer's instructions.

3.04 SCHEDULES

A. Hardware Groups:

1. Group # A (OFFICE 0711C, 0715A, 0715B) - Each opening to have:

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Office Lock	ND50PD RHO	626	SCH
1 Ea	Permanent Core	Type as Required	626	SCH
1 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

2. Group # B (STAFF LOUNGE 0779) - Each opening to have:

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Electric Butt Hinge 8 Through Wire	Per specification	652	IVE
1 Ea	Storeroom Mortise Lock	L9465	626	SCH
1 Ea	Permanent Core	Type as Required	630	SCH
1 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Edge Guard	EGC308	630	MAR
1 Ea	Kick Plate	Per Drawings		
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

NOTE: Keypad/Card reader, door position switch, and wiring by security vendor.

3. Group # C (HAZARDOUS DRUG HOLDING 0778 & NON-STERILE COMPOUNDING 0711A)

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Electric Butt Hinge 8 Through Wire	Per specification	652	IVE
1 Ea	Storeroom Mortise Lock	L9465	626	SCH
1 Ea	Permanent Core	Type as Required	630	SCH
1 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Edge Guard	EGC308	630	MAR
1 Ea	Kick Plate	Per Drawings		
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

NOTE: Keypad/Card reader, door position switch, and wiring by security vendor.
Door to receive auto operator, install to push side.

4. Group # D (RECEIVING AREA 0776)

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Electric Butt Hinge 8 Through Wire	Per specification	652	IVE
1 Ea	Storeroom Mortise Lock	L9465	626	SCH
1 Ea	Permanent Core	Type as Required	630	SCH
1 Ea	Auto Flush Bolt	962	630	DCI
1 Ea	Dust Proof Strike	82	630	DCI
2 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Coordinator	COR Series	626	IVE
1 Ea	Edge Guard & Astragal Set	EG308 x EGT308	630	MAR
1 Ea	Kick Plate	Per Drawings		
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

NOTE: Keypad/Card reader, door position switch, and wiring by security vendor.
Provide overhead stop by Glynn Johnson 90 Series in lieu of wall stop where
applicable.

5. Group #F (MULTI-USER RESTROOMS 0786 & 0784)

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Office Lock	ND50PD RHO	626	SCH
1 Ea	Permanent Core	Type as Required	630	SCH
1 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

6. Group #G (NARC PHARMACY 0762H)

Qty	Description	Catalog Number	Finish	Mfr
	Butt Hinges	Per specification	652	IVE
1 Ea	Electric Butt Hinge 8 Through Wire	Per specification	652	IVE
1 Ea	Storeroom Mortise Lock	L9465	626	SCH
1 Ea	Permanent Core	Type as Required	630	SCH
1 Ea	Surface Closer	4040XP RW/PA TBWMS	689	LCN
1 Ea	Edge Guard	EGC308	630	MAR
1 Ea	Kick Plate	Per Drawings		
1 Ea	Wall Stop	WS402CCV	626	IVE
1 Ea	Gasketing	188S-BK	S-BK	ZER

NOTE: Keypad/Card reader, door position switch, and wiring by security vendor.

END OF SECTION 08710

**SECTION 09250
GYPSUM BOARD**

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section includes all materials and installation necessary to provide Gypsum Board as shown and detailed on the drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 5, Section 05410 – METAL STUD SYSTEM
 - 2. Division 6, Section 06100 – ROUGH CARPENTRY
 - 3. Division 9, Section 09900 – PAINTING

1.02 QUALITY ASSURANCE

- A. References:
 - 1. Gypsum Association (GA):
 - a. GA-216: Recommended Specifications for the Application and Finishing of Gypsum Board.
 - b. GA-600: Fire Resistance Design Manual.
- B. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience.

1.03 SUBMITTALS

- A. General: Refer to Division 1, Section 01330 – Shop Drawings, Product Data and Samples.
- B. Samples: If specifically requested.
- C. Product Data: None required for specified products; required for alternate products.

1.04 PRODUCT HANDLING

- A. General: Refer to Division 1, Section 01310 – Coordination.

1.05 SITE CONDITIONS

- A. Requirements: Gypsum wallboard shall not be installed where it will have direct exposure to water or continuous humidity conditions. The contractor shall provide weather protection prior to installation of gypsum wallboard.
 - 1. Weather protection is required for all weather exposed surfaces and is generally provided by the exterior walls and roof. Surfaces that are not weather-exposed may have gypsum wallboard installed prior to the exterior walls being

constructed. This includes walls or portions of walls, beneath an upper floor deck or roof area, where located a horizontal distance from an exterior opening equal to at least twice the height of the opening.

2. Exterior openings shall include shafts or any other opening in the deck or roof above that are unprotected and could thus expose the gypsum wallboard to direct water. For example, if the building floor-to-floor height is 15 ft., gypsum wallboard may not be installed on walls within 30 ft. of the exterior slab edge or open shafts and other openings in the deck or roof above.
- B. Protection: There are three approaches to dealing with the weather protection requirements for gypsum wallboard installation:
1. Provide construction documents clearly describing how weather protection will be accomplished prior to the installation of gypsum wallboard.
 2. Submit a deferred submittal in accordance with the California Building Code, including construction documents clearly describing how weather protection will be accomplished prior to the installation of gypsum wallboard plans.
 3. Gypsum wallboard shall not be installed to weather exposed surfaces until the building is "weathered in," meaning that the exterior wall covering and roofing are installed, as required by the California Building Code.
- C. In addition to the requirements stated above, the project specifications and the manufacturer's installation instructions may also require temperature, humidity control and other conditions be maintained before, during and/or after the installation of gypsum wallboard.

PART II - PRODUCTS

2.01 MATERIALS

- A. Manufacture:
1. United States Gypsum Co.
 2. Gold Bond Building Products Division of the National Gypsum Corp.
 3. Or equal.
- B. Gypsum Wallboard:
1. General: ASTM C36; tapered edge where joint finish is required; 5/8" thickness, unless otherwise shown.
 2. Water-resistant: ASTM C630; use for walls in toilets only.
 3. Corner Beads And Casing: Galvanized steel, Dur-A-Bead No. 103 at exterior corners and No. 200B L-shaped casing without back flange, or equal.
- C. Joint System Materials:
1. General: ASTM C475.

2. Tape: Perf-A-Tape reinforcement, or equal.
 3. Joint Compound shall be USG or Hamilton Joint Compound – Taping, or equal.
 4. Joint Finishing Compound shall be USG or Hamilton Joint Compound – Topping.
 5. Or equal.
- D. Texture: Level 4 or better finish.
- E. Interior Wall Sealant:
1. Acoustical Sealant as manufactured by Tremco, Inc.
 2. Pecora Corp.
 3. Or equal.
- F. Gypsum Sheathing: Conform with ASTM C79; "Type X", or equal; 2'-0" x 8'-0" x $\frac{5}{8}$ ", tongue and groove edge, fire rated with UL label.
- G. Fasteners:
1. Fasteners to Wood Members:
 - a. Manufactured by the U.S. Steel Corp.
 - b. Commercial Steel and Supply Co., or equal.
 - c. Screws: Type W drywall screws.
 2. Fasteners to Metal Studs and Furring Channels: Use type S, Phillips, flat head, recessed, bugle shaped, self-drilling, self-tapping, rust inhibitive coated steel screws.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Division 1, Section 01310 – Coordination.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.

3.02 INSTALLATION

- A. General: Install in strict conformance with ASTM C840, other referenced standards, the manufacturer's written directions, as shown, and as herein specified.
- B. Gypsum Wallboard:
 1. Sheet Arrangement Layout:

- a. General: Install as shown; use long sheets to restrict joints to minimum.
 - b. Gypsum Sheathing: Apply horizontally; fasten 8" on center on each bearing point.
 2. Cutting and Scribing: Cut neatly to fit around outlets, switch boxes and other protrusions.
 3. Joints: Butt sheets loosely together with tapered edges placed together; butt edges placed next to tapered edges are not acceptable. Sand or kerf cut edges and mill ends to provide smooth jointing on exposed face. Stagger end joints. Shim wallboard as required to provide even joints, without offsets.
 4. Fasteners:
 - a. General: Place not less than $\frac{3}{8}$ " from edges of board, with heads dimpled slightly below surface; do not cut through paper.
 - b. Ceilings, Non-rated: screws, 12" on center.
 - c. Walls, Non-rated: screws, 12" on center.
 5. Resilient Metal Clips: Fasten to wall at 24" on center. Position clips 4" off floor and ceiling, and spaced not more than 24" on center. Apply gypsum board with 1" long Type S screws at 12" on center, with horizontal abutting edges centered over clips.
 6. Trim: Place control joints consistent with lines of building; corner beads at exterior corners; and casing beads where wallboard abuts other materials, and as shown.
 7. Interior Wall Sealant: Install double bead of sealant at floor, wall intersections, where walls abut other materials, electrical boxes and any other penetrations of interior partitions.
 8. Partitions: Place boards with long dimensions either vertical or horizontal on studs; stagger vertical joints on opposite sides of partitions; keep end joints to minimum. Locate joints a minimum of 12" from jambs of openings.
 9. Ceilings: Install boards with long dimension at right angles to supports; end joints, perimeter of ceiling and edge of openings over solid bearing members.
- C. Finishing:
1. General: Finish joints, fastener depressions, applied metal trim and surface blemishes per manufacturer's directions.
 2. Finished Wallboard: Sand as necessary to provide flat, smooth surface ready for decoration.
 3. Concealed Wallboard: Wallboard covered by panels or wall-fastened casework, and wallboard above level of finished ceiling, does need to be sanded smooth.
 4. Textured Surfaces: Level 4 or better finish.

3.03 CLEANING

- A. See Division 1, Section 01740 – Cleaning
- B. Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris from the site.

END OF SECTION 09250

SECTION 09310 CERAMIC TILE

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes: Description of the requirements for materials and installation of ceramic tile and associated accessory items, as indicated on Drawings and necessary to provide a complete and proper installation.
- B. Related Sections:
 - 1. Section 07901 – Joint Sealers, except as included herein.
 - 2. Section 09250 – Gypsum board (wall substrate).
 - 3. Section 10810 – Toilet Room Accessories.

1.02 QUALITY ASSURANCE

- A. Standards of Manufacture: Specific reference to manufacturer's names and products specified herein are used as standards, but this implies no right to substitute other materials or methods without written acceptance of Architect. Refer to the General Conditions for procedures governing substitutions.
 - 1. Provide all like products of this Section from a single manufacturer.
- B. Installer Qualifications: Installation shall be done only by installation firm normally engaged in this business. Work shall be performed by qualified installers working under an experienced supervisor.
- C. References and Standards (latest Edition unless noted otherwise):
 - 1. American Society for Testing and Materials (ASTM).
 - 2. Federal Specification (FS).
 - 3. Tile Council of America, Inc. (TCA) – “Handbook for Ceramic Tile Installation”, 2001 Edition.
 - 4. American national Standards Institute, (ANSI):
 - a. A108.5 – “Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar”.
 - b. A108.010 – “Installation of Grout in Tile Work”.
 - c. A118.01 – “Dry-Set Portland Cement Mortar”.
 - d. A118.6 – “Ceramic Tile Grout”.
 - e. A137.01 – “Specifications for Ceramic Tile”.

- D. Design Criteria: Tile work shall be clean and durable; no discolored or crumbling joints, loose tile, or cracks shall develop. Correct to the University's satisfaction above conditions which occur within warranty period.

1.03 SUBMITTALS

- A. Submit the following:

1. List of materials: Complete listing of all materials proposed for use, with manufacturer's data. Indicate location of each.
2. Manufacturer's "Master Grade Certificate" bearing Tile Council of America (TCA) certification mark for each type of tile.
3. Samples:
 - a. Samples for Initial Selection Purposes: Submit manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures and patterns available for each type of tile indicated. Include samples of grout and accessories involving color selection.
 - b. Samples for Verification Purposes. Submit the following:
 - 1) Samples for each type of tile and for each color and texture required, not less than 12" square, on plywood or hardboard backing and grouted.
 - 2) Full size samples for each type of trim, accessory and for each color.
4. Certified Test Reports: Submit certified test reports from a qualified independent testing laboratory evidencing compliance of tile and tile setting products with requirements specified based on comprehensive testing of current products. Include in reports testing laboratory's interpretation of test results relative to specified requirements.
5. Manufacturer's maintenance instructions and recommendations for maintaining ceramic tile.
6. Maintenance Materials:
 - a. Prior to final inspection, furnish the University with two percent of total quantity of each type and color of tile and grout used.
 - b. Provide in either unopened manufacturer's cartons or dustproof packaging plainly marked with type, color, and quantity of contents.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.
- B. Ensure timely delivery so products will be available at Project site when required for installation so as not to delay job progress.

1.05 JOB CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's recommendations.
- B. Maintain temperature at not less than 50°F (10°C) in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, tile manufacturers offering products which may be incorporated in the work include, but are not limited to, manufacturer's identified in tile types, sizes, colors and patterns listed on the Drawings, and manufacturers of mortar, grout, and tile cleaners as follows:
 - 1. Latex-Portland Cement Mortars: American Olean Tile Co., Inc.; H.B. Fuller Co.; Laticrete International, Inc.; or equal.
 - 2. Commercial Portland Cement Grouts: American Olean Tile Co., Inc.; H.B. Fuller Co.; Laticrete International, Inc.; or equal.
 - 3. Latex-Portland Cement Grouts: American Olean Tile Co., Inc.; H.B. Fuller Co.; or equal.
 - 4. Tile Cleaners: Hillyard Chemical Co.; L & M Surco Mfg. Co., Inc.; or equal.

2.02 MATERIALS

- A. Requirements:
 - 1. ANSI Standard for Ceramic Tile: Comply with ANSI A137.01 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.
 - a. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
 - 2. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
 - 3. **ASTM 2048: Coefficient of friction**.
 - 4. Colors, Textures and Patterns: For tile, grout and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standards.
 - a. Provide tile trim and accessories which match color and finish of adjoining flat tile.
 - 5. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

- B. Floor Tile: As specified on the Drawings.
- C. Wall Tile: As specified on the Drawings.
- D. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
 - 1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.
 - 2. Shapes: As follows, selected from manufacturer's standard shapes:
 - a. Base for Thinset Mortar Installations: Straight.
 - b. External Corners for Thinset Installations: Surface bullnose.
 - c. Internal Corners: Field-buttet square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.
 - d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finished of different thickness, tapered to provide a reduction in thickness from $\frac{1}{2}$ " to $\frac{1}{4}$ " across nominal 4" dimension.
- E. Setting Materials: Provide materials to comply with referenced standards; as required for installation method designated.
- F. Grouting Materials: Provide Commercial Portland Cement Grout; complying with ANSI A118.6; of color selected by Architect.
- G. Tile Cleaner: Product specifically acceptable to manufacturer of tile and gout manufacturer for application indicated and as recommended by National Tile Promotion Federation or Ceramic Tile Institute.

2.03 MIXING MORTARS AND GROUT

- A. Mix mortars and gouts to comply with requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and gouts of uniform quality with optimum performance characteristics for application indicated.

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive tile work and conditions under which tile will be installed. Do not proceed with tile work until surfaces and conditions comply with requirements indicated in referenced tile installation standard.

3.02 INSTALLATION GENERAL

- A. ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.
- C. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.
- E. Jointing Pattern: Unless otherwise show, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.
 - 1. For tile mounted in sheets make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- F. Expansion Joints: Locate expansion joints and other sealant filled joints, including control, contraction and isolation joints, where indicated. Do not saw cut joints.
 - 1. Prepare joints and apply sealants to comply with requirements of referenced standards and sealant manufacturer.
- G. Grout tile to comply with the requirements of the following installation standards:
 - 1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts) comply with ANSI A108.010.

3.03 TILE INSTALLATION

- A. Install types of tile designated for wall and floor application to comply with ANSI Specifications for ceramic tile.

3.04 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean ceramic tile surfaces so they are free of foreign matter.
 - 1. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.
- C. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage and wear.

1. Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.
2. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09310

SECTION 09510
ACOUSTICAL TILE CEILINGS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section includes all materials and installation necessary to provide Acoustical Ceilings, as shown and detailed on the drawing and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 15 – MECHANICAL WORK: Air grilles and Diffusers.
 - 2. Division 16 – ELECTRICAL WORK: Light Fixtures.

1.02 QUALITY ASSURANCE

- A. References:
 - 1. General: Provide completely designed system complying with Section 808 of CBC and specified herein.
 - 2. Ceilings and Interior Systems Contractors Association (CISCA): Acoustical Ceilings, Use and Practice.
 - 3. Underwriters Laboratory (UL): Fire Resistance Directory and Building Material Directory.
 - 4. AC 368: Acceptable Criteria for Suspended Ceiling Framing Systems
 - 5. 2010 California Building Code
- B. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience.

1.03 SUBMITTALS

- A. General: Refer to Division 1, Section 01330 – Shop Drawings, Product Data and Samples.
- B. Shop Drawings: Submit shop drawings showing suspension system details and reflected ceiling plans indicating location of light fixtures, mechanical air supply and return outlets and other items affecting ceiling construction. Identify locations of types of suspension systems and types of panels or tile including access panels, where required.
- C. Samples:
 - 1. Acoustical Board: Submit manufacturer's standard color range.
 - 2. Suspension System: Submit manufacturer's standard color range.
- D. Product Data: Manufacturer's specification, data, and installation instructions.

- E. Certificates: Manufacturer's certified test reports for each specified NRC and STC requirement.

1.04 PRODUCT HANDLING

- A. General: Refer to Division 1, Section 01310 – Coordination.

1.05 SITE CONDITIONS

- A. Environmental Requirements: Maintain temperature approximating operational conditions, before, during and after installation; humidity not more than 70%.

1.06 MAINTENANCE

- A. General: Refer to Division 1, Section 01770 – Closeout Procedures.
- B. Extra Stock: Deliver one (1) percent or a minimum of one full container of each kind and type of acoustical material installed.
- C. Guarantee: On form provided at end of Section 01780 – CLOSEOUT SUBMITTALS, provide one (1) year written guarantee commencing from date of final acceptance by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

- A. Manufacture:
 - 1. Specified products are manufactured by Armstrong World Industries, Inc., unless otherwise indicated.
 - 2. USG Interiors, Inc., or equal
- B. Acoustical Panels:
 - 1. Armstrong World Industries, Inc.; "Clean Room FL", square edge, soil-resistant polyester film surface finish, color – white, minimum NRC 0.55; fire performance Class A (ASTM E84); ASTM E1264 classification Type IV, Form 2, Pattern G H; washable, scrubbable; or equal.
- C. Ceiling Suspension System:
 - 1. Exposed system of steel components; fire endurance rated where shown, complying with DSA IR 47-4, manufactured by the Chicago Metallic Corp.
 - 2. USG Interiors, Inc. or equal
 - 3. Standard Sections: Heavy-duty (16 lb/ft) main and cross runner members, assembly devices, wall moldings; other accessories as required; factory-painted in color selected by University's Representative.
 - 4. Hanger Wires: 12 gage when spaced at 4 ft. or 10 gage when spaced at 5 ft., galvanized, soft-annealed mild steel wire of gage certified by load test data as capable of carrying five (5) times design load.

- 5. Compression Struts:
 - a. "Donn Compression Post" manufactured by the USG Interiors, Inc.
 - b. Armstrong World Industries or equal
- D. Acoustical Sealant: As recommended by acoustical material manufacturer, for application shown.
- E. Wall Molding:
 - 1. Molding shall have a horizontal flange of at least 2", unless otherwise required. The 2" wall angle is required at the attached and unattached perimeters.
 - 2. Armstrong 2" BERC Clip (BERC 2), or approved equal may be used in lieu of the 2" wall angle when 7/8" wall molding is used, and when the seismic strut layout is started within 5 feet of two adjacent walls.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Division 1, Section 01310 – Coordination.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Surface Preparation: Comply with ASTM C636 Article 3, Interference of Ceiling Related Components; coordinate requirements with other trades. Verify that required work has been installed above ceiling and that perimeter wall work, where ceiling abuts, is completed and dry.

3.02 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Ceiling Suspension System:

1. General: Conform to ASTM C636 and ASTM E580 and 4701(E) of CBC and suspension system manufacturer's instructions, non-cumulatively; main runners at 4'-0" on center, with support wires at 4'-0" on center, maximum; exposed members parallel with one another, in grid layout as shown.
2. Splices and Intersections: Install with interlocking device that draws members tightly together and prevents torsional deflection.
3. Compression Struts: Install as shown.
4. Perimeter Molding and Grid: Install intersections so fastenings are concealed, as shown.
5. Tolerances: Erect ceiling system level within $\frac{1}{8}$ " in 12'-0" in any direction.
6. The ceiling grid must be attached to the molding at two adjacent walls.
7. Unattached ends of the grid system must have $\frac{3}{4}$ " clearance from the wall, and must rest upon and be free to slide on the molding.
8. Hanger wires must be plumb within 1 in 6 unless counter sloping wires are provided.
9. Hanging and seismic bracing wires must be 6" minimum clear from unbraced conduits, pipes, ducts, etc., and 1" minimum from braced conduits, pipes, ducts, etc.

C. Acoustical Panels: Install in ceiling suspension system, as shown.

D. Acoustical Tile:

1. Tile: Install smooth, level or plumb, as shown; with exposed tile joints true and straight, and junctures neat, tight and properly trimmed. Unevenness, edge or corner offsets, cupping, scratches, broken tile or other imperfections, not acceptable.
2. Adhesive: Place 1- $\frac{1}{4}$ " diameter, minimum, spots of adhesive at corners. Press and slide tile into place with face surface aligned and level.

E. Gypsum Board Inserts: Provided under Division 9, Section 09250 – Gypsum Board and painted under Section 09900 – Painting. Install each panel on perimeter bead of acoustical sealant and attach hold-down clips.

F. Light Fixtures:

1. All fixtures must be positively attached to the suspension system. The attachment device must be able to withstand 100% of the weight of the fixture acting in any direction.
2. Fixtures weighing 56 lbs. or less must have two 12-gage wires attached at diagonal corners. These wires may be slack.

3. Fixtures weighing more than 56 lbs. must be independently supported from the building structure.

G. Mechanical Services:

1. Mechanical services less than 20 lbs. must be positively attached to the suspension system main beams or cross tees.
2. Terminals or services weighing 20 lbs. to 56 lbs. must have two 12-gage wires connecting them to the ceiling system hangers or to the structure above.
3. Terminals or services weighing more than 56 lbs. must be independently supported.

H. Penetrations:

1. Ceilings without a grid brace must have 2" oversize trim rings to allow 1" horizontal movement in all horizontal directions at sprinkler heads and other penetrations.

3.03 ADJUSTMENT

- A. General: Adjust sags or twists which develop in ceiling systems; replace improperly installed or damaged suspension system components and acoustical panels, as directed by University's Representative.

B. Tolerances:

1. Maximum Variation from Flat and Level Surface: $\frac{1}{8}$ " in 10'-0".
2. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.04 CLEANING

- A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 09510

**SECTION 09651
RESILIENT TILE FLOORING**

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Resilient Tile Flooring as shown and detailed on the Drawings and specified herein and includes:
 - 1. Vinyl Composition Floor Tile
 - 2. Rubber Floor Tiles
- B. Related Sections include the following:
 - 1. Division 9 – RESILIENT WALL BASE and ACCESSORIES for resilient wall base, reducer strips, and other accessories installed with resilient floor tiles.

1.02 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Sample tiles of each color and pattern of resilient floor tile specified, showing the full range of variations characteristics.
 - 1. For resilient tiles, manufacturer's standard-size samples.
- C. Product Certificates: Signed by manufacturers of resilient products certifying that each product furnished complies with requirements.
- D. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source and dye lot per room with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire Test Response Characteristics: Provide products with the following fire-test response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts/ cm² or greater when tested per ASTM 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, including dye lot number and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50° and 90°F.
- C. Store tiles on flat surfaces with cartons upright.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.05 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 65°F or more than 100°F in spaces to receive products for at least 48 hours prior to installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55°F or more than 95°F.
- B. Condition all flooring materials and adhesives to room temperature prior to starting installation at the space where they are to be installed.
- C. Cordon off spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive. See 3.1 "Examination" of this Specification.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents and Project location.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
 - 2. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
 - 3. Deliver extra materials to University.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Resilient Tile Flooring Schedule at the end of Part 3.
- B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Resilient Tile Flooring Schedule at the end of Part 3.
- C. Manufacturers: Nora System, Mannington, Armstrong, Tarket, Azrock, or equal.

2.02 RESILIENT TILE

- A. Mannington, Essentials Color #131 Oyster White
- B. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Resilient Tile Flooring Schedule.

2.03 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- C. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are free of defects and fully comply with manufacturer's specified requirements for resilient product installation. Determine adhesion and dryness by performing flooring manufacturers recommended bond test and ASTM Standard F2170 test method using in Situ Probes to test for relative humidity. Concrete slabs moisture levels cannot exceed manufacturer's recommendations for moisture. Provide University's Representative with test results prior to installation for all concrete slabs.

- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing a bond test and a F2170 test method using in Situ Probes. Report all test results to the University's Representative.
 - 2. Subfloor finishes comply with requirements specified in "Division 3, Section 03300 – Cast-in-Place" Concrete for slabs receiving resilient flooring.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected including but not limited to excessive moisture mitigation – refer to section 07264 Water Vapor Emission Control Barrier.

3.02 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Use stair-tread-nose filler, according to resilient tread manufacturer's written instructions, to fill nosing substrates that do not conform to tread contours.
- D. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- E. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
 - 1. Lay tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay all tiles with grain running in north/south direction. Do not quarter turn tiles.
 - 2. Lay tiles in pattern of colors and sizes indicated on Drawings.

- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around and to covers.
- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Hand roll tiles according to tile manufacturer's written instructions.

3.04 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions, refer to Division 9, Section 09653 – Resilient Flooring Accessories.

3.05 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing Vinyl Composition resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by flooring manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Perform the following operations immediately after installing Rubber Tiles resilient products: Initial Cleaning performed a minimum of 72 hours after the installation.
 - 1. Remove any adhesive residue.
 - 2. Dust Mop or vacuum floor thoroughly.
 - 3. Wet mop the floor using a diluted initial maintenance product and allow the solution a minimum dwell time of 10 minutes.

4. Scrub the floor thoroughly with a floor scrubber using a 3M #5100 (red) cleaning pad for all rubber tile surfaces and a #5300 (blue) cleaning pad and a high pH cleaner/degreaser for all rubber tiles surfaces.
 5. Wet vacuum the soiled solution, rinse the floor with clean water and allow to dry.
- C. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.
1. Apply protective floor polish to VCT floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to the VCT flooring manufacturer.
 - b. Coordinate selection of floor polish with University's maintenance service.
 2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
 3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- D. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
1. Before cleaning VCT tile floors, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
 2. After cleaning VCT floor tiles, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with University's maintenance program.
 3. Rubber Floor tiles; after initial cleaning described above, to increase shine the floor dry buff using a 3M #4100 (white) pad

3.06 RESILIENT TILE FLOORING SCHEDULE

- A. Vinyl Composition Tile VCT. Where this designation is indicated, provide vinyl composition floor tile complying with the following:
1. Products: Mannington Commercial, Inc. or equal.
 2. Color and Pattern: Essentials, #131 Oyster White
 3. Class: Class 2 - through pattern
 4. Thickness: $\frac{1}{8}$ " (3.2 mm)

5. Size: 12" x 12" tile
 6. Static Load Limit: 75 psi (5.27 kg/cm²) per test method ASTM F 970.
 7. Fire Test Data: Class 1.
- B. Rubber Floor Tiles Where this designation is indicated, provide vinyl composition floor tile complying with the following:
1. Products: Noraplan, Degree by Nora Systems Inc. or equal.
 2. Color and Pattern:
 3. Thickness: 0.12"
 4. Size: 24" x 24" tile
 5. Static Load Limit: 550 psi, 800 pounds per test method ASTM F 970.
 6. Fire Test Data: Class 1.

END OF SECTION 09651

SECTION 09652 SHEET FLOOR COVERINGS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work of this Section includes all materials and installation necessary to provide Sheet floor coverings as shown and detailed on the Drawings and specified herein.
- B. Related Sections include the following:
 - 1. Division 9, Section 09653 – RESILIENT FLOORING ACCESSORIES
 - 2. Division 7, Section 07264 – WATER VAPOR EMISSION CONTROL BARRIER

1.02 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: Show location of seams and edges. Indicate location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutout locations.
- C. Samples for Verification: In manufacturer's standard size, but not less than 6" x 9" sections of each different color and pattern of sheet floor covering specified, showing the full range of variations expected in these characteristics.
 - 1. For heat-welding bead, manufacturer's standard-size samples, but not less than 9" (230 mm) long, of each color specified.
- D. Product Certificates: Signed by manufacturers of sheet floor coverings certifying that each product furnished complies with requirements.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- F. Maintenance Data: For sheet floor coverings to include in the maintenance manuals specified in Division 1.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer who is certified by floor covering manufacturer in the technique required by manufacturer for heat-welding seams.
 - 1. Engage installers who are certified by floor covering manufacturer for heat-welded seam installation.
- B. Source Limitations: Obtain each type, color, and pattern of sheet floor covering specified from one source and one (1) dye lot per room with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet vinyl floor coverings and installation accessories to Project site in manufacturer's original protective wrap, (omit text) each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50° and 90°F.
- C. Store rolls upright or as instructed by the manufacturer.
- D. Move floor coverings and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer.

1.05 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70°F or more than 95°F in spaces to receive sheet floor coverings for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55°F or more than 95°F.
- B. Do not install sheet floor coverings until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during sheet floor covering installation and for time period after installation recommended in writing by manufacturer.
- D. Install sheet floor coverings and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of sheet floor coverings, install floor coverings before these items are installed.
- F. Examine existing substrates, do not install flooring until concrete slabs have cured and are sufficiently dry to bond with adhesives. See 3.01 Examination and comply with all the requirements.
- G. Do not proceed with installation until unsatisfactory conditions have been corrected including but not limited to excessive moisture mitigation – refer to section 07264 Water Vapor Emission Control Barrier.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet in roll form for each 500 linear feet or fraction thereof, of each different composition, wearing surface, color, and pattern of sheet vinyl floor covering installed.
 - 2. Deliver extra materials to University.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Nora System Rubber Flooring, Armstrong Sheet Vinyl, Mannington Sheet Vinyl or approved equal.

2.02 SHEET VINYL FLOOR COVERINGS

- A. Rubber Flooring; Products complying with ASTM F1859, Type I, Class 1
- B. Sheet Vinyl Floor Coverings: Products complying with ASTM F 1303, Type II, Class 1, Grade A or equal.

2.03 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by floor covering manufacturer for applications indicated.
- B. Adhesives: Non-flammable water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.
 - 1. Quick Set Adhesives are acceptable if approved by flooring manufacturer
- C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer for heat-welding seams.
 - 1. Color: Match color of sheet floor material.
- D. Cove Strip: 1" radius support for integral flash cove base provided or approved by floor covering manufacturer.
- E. Cove-Base Cap Strip: Square metal, vinyl, or rubber cap for integral flash cove base provided or approved by floor covering manufacturer.
- F. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of sheet vinyl floor coverings, and in maximum available lengths to minimize running joints.

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine existing substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify the substrates and conditions are free of defects and fully comply with manufacturer's specified requirements for resilient product installation. Determine adhesion, moisture and PH levels by conducting the following tests conducted by Independent Testing Agencies certified by ICRI (International Concrete Repair Institute). Provide test results to the University's Representative prior to the flooring installation. (Consultant to omit if all new concrete substrates – or reduce text if PH and Insitu probe test is not required by University's Representative)
 - 1. Refer to Section 07264 – Water Vapor Control Barrier, Submittals – 1.04, D Testing and comply with all requirements.
 - 2. ASTM D 7234 - Standard Adhesion Strength test
 - 3. ASTM F 2170 – Standard test to measure relative humidity using Insitu Probes manufactured by Wagner Electronics.
 - 4. ASTM F 710 – Standard test to measure Alkalinity levels conducted with an electronic PH Meter manufactured by Wagner Electronics.
- B. New Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
- C. Do not install sheet floor coverings over “new” concrete slabs until they have fully cured, free of defects and are sufficiently dry to bond with the adhesives. Verify the substrates and conditions fully comply with manufacturer's specified requirements for resilient product installation. Determine adhesion, moisture and PH levels by conducting the following tests conducted by Independent Testing Agencies certified by ICRI (International Concrete Repair Institute). Provide the test results to the University's Representative prior to any floor installation. (Consultant to omit if all new existing substrates).
 - 1. Refer to Section 07264 – Water Vapor Control Barrier, Submittals – 1.04, D Testing and comply with all requirements.
 - 2. ASTM D 7234 - Standard Adhesion Strength test
 - 3. ASTM F 2170 – Standard test method for relative humidity using Insitu Probes manufactured by Wagner Electronics.
 - 4. ASTM F 710 – Standard test to measure Alkalinity levels conducted with an electronic PH Meter manufactured by Wagner Electronics.
 - 5. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.
 - 6. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

- D. For wood subfloors, verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Division 6 Section "Rough Carpentry."
 - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond, show through surface, or stain sheet vinyl floor coverings.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with sheet vinyl floor covering manufacturer's written installation instructions for preparing substrates indicated to receive sheet vinyl floor coverings.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing sheet vinyl floor coverings. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. General: Comply with sheet vinyl floor covering manufacturer's written installation instructions.
- B. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting, if recommended in writing by manufacturer.
- C. Lay out sheet vinyl floor coverings to comply with the following requirements:
 - 1. Maintain uniformity of sheet vinyl floor covering direction.
 - 2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6" away from parallel joints in flooring substrates.
 - 3. Match edges of sheet vinyl floor coverings for color shading and pattern at seams according to manufacturer's written recommendations.
 - 4. Avoid cross seams.
 - 5. No cross seams at doorways.
- D. Scribe, cut, and fit sheet vinyl floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.

- E. Integral Flash Cove Base: Where indicated, cut sheet vinyl floor coverings to form integral base of height indicated at vertical surfaces.
- F. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- H. Install sheet floor coverings on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- I. Adhere sheet floor coverings to flooring substrates to comply with floor covering manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 - 2. Form integral flash cove base by flashing floor covering up vertical surfaces. Support floor covering at horizontal and vertical junction with cove strip. Butt floor covering at top of base against cap strip.
- J. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into a seamless floor covering. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining floor covering surfaces.
- K. Hand roll sheet floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.04 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing Sheet Vinyl floor coverings:
 - 1. Remove adhesive and other surface blemishes using non-flammable cleaner recommended by floor covering manufacturer.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor covering until after time period recommended by floor covering manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Perform the following operations immediately after installing sheet Rubber floor coverings: Initial Cleaning – minimum 72 hours after installation.
 - 1. Remove adhesive and other surface blemishes using non-flammable cleaner recommended by floor covering manufacturer.

2. Sweep or vacuum floor thoroughly.
 3. Wet mop the floor using a diluted initial maintenance product and allow the solution minimum dwell time of 10 minutes.
 4. Scrub the floor thoroughly with a floor scrubber using a 3M #5100 (red) cleaning pad for all Noraplan surfaces and a 3M #5300 (blue) cleaning pad and a high PH cleaner/degreaser for all rubber surfaces.
 5. Wet vacuum the soiled solution, rinse the floor with clean water and allow to dry.
- C. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by floor covering manufacturer.
1. Cover sheet vinyl floor coverings with undyed, untreated building paper until inspection for Substantial Completion.
 2. Do not move heavy and sharp objects directly over sheet floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- D. Clean sheet floor coverings not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean floor coverings according to manufacturer's written recommendations.

3.05 SHEET VINYL FLOOR COVERING SCHEDULE (Consultant to modify)

- A. Products: Noraplan Degree Rubber Sheet flooring, Armstrong Medintech Homogeneous Sheet Flooring, or Inlaid Medintech Tandem, Mannington Inlaid Fine Fields, Resilient Floors, or equal. (Consultant to modify)
- B. Noraplan Rubber Sheet Flooring; Degree is a solid rubber sheet flooring
1. Color; Selected by Architect
 2. Overall thickness; 0.012"
 3. Sheet width: 4' wide
 4. Fire Test Data: Class 1
 5. Installation method: Use adhesives recommended by the manufacturer
 6. Finish: After initial cleaning to increase shine, dry buff floor the floor with a 3M #1400 (white) pad as recommended by the manufacturer.
- C. Armstrong Medintech Homogeneous flooring materials are a nonbacked, nonlayered, polyurethane-coated vinyl with a through pattern construction with UV cured polyurethane finish.
1. Color: Freesia Pearl #88488 or approved equal
 2. Overall Thickness: 0.080"

3. Sheet Width: 6' wide
 4. Fire Test Data: Class I.
 5. Installation Method: Use Adhesive as recommended by the flooring manufacture. Or approved Quick Set adhesives
 6. Finish: No Polish Dry Buff, Spray Buff, Polish Optional Consultant to modify
- D. Armstrong Medintech Inlaid Sheet Products have a wear layer composed of polyvinyl chloride resin, stabilizers, fillers, and pigments on a backing suitable for use on approved subfloors on all grade levels.
1. Color; Freesia Pearl #88487 or approved equal
 2. Overall Thickness: 0.080"
 3. Wearing Surface: 0.060"
 4. Sheet Width: 6' wide
 5. Fire Test Data: Class I.
 6. Installation Method: use adhesive as recommended by the manufacturer.
 7. No Polish Dry Buff, Spray Buff, Polish Optional
- E. Mannington Inlaid Fine Fields, a urethane wear layer composed of polyvinyl chloride resin, stabilizers, fillers, and pigments on a backing suitable for use on approved subfloors on all grade levels.
1. Color; Sandrift #10303 or approved equal
 2. Overall Thickness: 0.080"
 3. Wearlayer Surface: 0.066"
 4. Sheet Width: 6' wide
 5. Fire Test Data: Class I.
 6. Installation Method: Use adhesive and recommended by manufacturer. Detailed instruction may be found in the "Mannington Professional Installation Guide.
 7. No polish, No buffing.

END OF SECTION 09652

SECTION 09 78 13
INTERIOR MODULAR METAL WALL PANEL SYSTEM (MWPS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Modular Metal Wall Panel System, as indicated, in accordance with provisions of Contract Documents.
- B. Section Includes:
 - 1. Stainless steel modular wall panels for Operating Rooms.
- C. Coordinate with work of other trades.
 - 1. Coordinate locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
 - 2. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
 - 3. Coordinate with mechanical and electrical requirements.
 - 4. Schedule installation of medical equipment in each room or space such that construction activity of other trades is essentially complete prior to commencement.

1.2 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of medical equipment exposed to view in same areas, unless otherwise approved by Architect.
- B. ASTM Standards:
 - 1. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
 - 2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 3. ASTM C1177/C1177M Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 4. ASTM C1396/C1396M Standard Specification for Gypsum Board
 - 5. ASTM C1658/C1658M Standard Specification for Glass Mat Gypsum Panels
 - 6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 7. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- C. LEED Requirements:
 - 1. Refer to Section 01 81 17, LEED HC v4 Requirements, for additional performance requirements that may apply to products specified in this section.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Detailed drawings showing each component of system in plan and elevation, indicating dimensions and details of construction, installation, and interface with related services.
 - 2. Manufacturer shall review shop drawings with hospital staff to verify locations and "handling" of or installation of equipment.
- B. Product Data:
 - 1. Manufacturer's literature indicating construction details, material descriptions and thicknesses, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified, and fire test information in compliance with specifications.

2. Material Certificates: Submit certification materials have been tested and comply with specified requirements.
- C. Samples:
1. Two 8 IN x 4 IN pieces of exposed components in specified finish.
- CI. Contract Closeout Information:
1. Maintenance data:
 - a. See Section 01 78 23.
 2. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - 2) See Section 01 78 26.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Coordinate the delivery and installation of this work with the Contractor's schedule.
- B. Inspect materials upon delivery. Replace any panels or components damaged during shipment, storage, or handling with new identical factory-supplied components.
- C. Protect finishes from physical damage by leaving factory packing cases in place before installation and providing temporary protective covers after installation with on-going construction within the Project area.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Modular Metal Wall System:
 1. mfPHD, LLC (contact: Tom Crenshaw 254-717-0133, tcrenshaw@mfphd.com).
 2. Made in the U.S.A.
2. Other manufacturers desiring approval shall comply with Section 00 26 00.

2.2 PERFORMANCE REQUIREMENTS

1. Design and construct panels to meet requirements as indicated.
 1. Surface Burning Characteristics: Panels shall have been tested in accordance with ASTM E84 for surface burning characteristics. Panels shall have a flame spread of <10 and smoke developed of ≤ 25 for Class A fire rated.
 2. Adjustability: Finished panels must be able to accommodate the increase or decrease in width, due to variations between plan and field dimensions, while maintaining all original properties.

2.3 MATERIALS

1. Stainless Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard of flatness, polished to No.4 Finish and/or Powder Coat Finish, 1.22mm thick.
2. Interior Gypsum Board:
 1. 5/8 IN Type X moisture- and mold-resistant panels for use on walls. Comply with ASTM C1177, C1396, C1658 and D3273.
 2. Products:
 - a. USG Sheetrock Brand Mold Tough Panels Firecode X.
 - b. USG Brand UltraLight Panels Mold Tough Firecode X.
 - c. Georgia-Pacific ToughRock Fireguard X Mold-Guard Gypsum Board.
3. Aluminum Extrusions: ASTM B221/B221M, with alloy and temper required to suit structural and finish requirements.
4. Gasket: EPDM – ethylene propylene diene monomer (M-Class) rubber.
 1. Finish: As selected by Architect from manufacturer's full range of finishes.

2.4 FABRICATION

1. Wall Panels:
 1. Panels: Adhere stainless steel face sheets to Type X moisture & mold resistant gypsum board.
 2. Edges: All edges of the panel are returned back to cover the gypsum. The vertical seams are returned back to cover the panel and then turned to create a fastening flange.
 3. Corners and Angles: All inside and outside are solid piece construction. 90's, 45's, 22.5 degree angles are formed out of a single panel to eliminate corner joints. Any angle is possible.
 4. Gasket: Push in manually between panels to create a water tight seal.
 5. Adjustability: Finished panels must be able to accommodate the increase or decrease in width, due to variations in the field between plans and field dimensions, while maintaining all original properties.
2. Windows:
 1. Glass: 6mm safety glass.
 2. Frame: 14 gauge stainless steel.
 3. Integral Blinds: tilt for privacy or viewing and completely retract.
 4. Control: Control buttons are located by owner
 5. Lead: Lead value to be determined by owner/physicists specification
3. Cabinets:
 1. Material: Walls, shelves and doors are 1mm 304 stainless steel wrapped around a corrugated honeycomb core. Sandwich panel design.
 2. Door glass: 6mm safety glass
 3. Hinges: Concealed hinge design

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.
- B. If support system preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instructions and industry standards.
- B. Fasteners according to manufacturer's recommendations and installer.
- C. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- D. Install gaskets and trim true and in proper alignment.
- E. Utilize standard stud framing for installation

3.3 FIELD QUALITY CONTROL

- A. Installer shall make periodic inspections and issue report to Architect regarding compliance with manufacturer's installation recommendations developed for the project.

3.4 ADJUSTING AND CLEANING

- A. Repair damage caused during construction.
 1. Touch-up mars, scratches, and cut edges to match original finish.

2. If repairs cannot be made to comply with Architect's requirements, remove damage panels and install new panels.
- B. Wipe finished surfaces clean of any filings caused by drilling or cutting to prevent rust staining.
- C. Clean entire surface again prior to closeout.

END OF SECTION

SECTION 10155 TOILET COMPARTMENTS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Steel, color-coated finish, floor anchored Toilet Compartments and Privacy Screens as shown and detailed on the Drawings and specified herein.
- B. Related Sections:
 - 1. Division 10, Section 10801 – Toilet and Bath Accessories for toilet paper holders, grab bars and similar accessories.

1.02 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
- C. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.
- D. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.03 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements: Ampco Products, Inc., Bobrick Washroom Equipment, Inc., or equal.

2.02 MATERIALS

- A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- B. Steel Sheets for Color-Coated Finish: Provide mill-phosphatized steel sheet that is leveled to stretcher-leveled flatness complying with the requirements of standards indicated below:
 - 1. Electrolytically Zinc-Coated Steel Sheet: ASTM A 591 (ASTM A 591M), Class C, of the following minimum thicknesses:
 - a. Panels and Screens: 0.0359" (0.9 mm).
 - b. Doors: 0.0299" (0.75 mm).
 - c. Tapping Reinforcement: 0.0747" (1.9 mm).
- C. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, that is leveled to stretcher-leveled flatness, finished on exposed faces as indicated in the "Stainless-Steel Sheet Finishes" Article, and of the following minimum thicknesses:
 - 1. Panels and Screens: 0.0375" (0.95 mm).
 - 2. Doors: 0.0312" (0.8 mm).
 - 3. Tapping Reinforcement: 0.0781" (2.0 mm).
- D. Core Material for Metal-Faced Units: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1" (25 mm) minimum for doors, panels, and screens and 1-1/4" (32 mm) minimum for pilasters.
- E. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:
 - 1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.
- F. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
 - 1. Material: Clear-anodized aluminum.
- G. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
 - 1. Material: Stainless steel.
- H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.03 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
 - 1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.
- B. Metal-Faced Toilet Compartments and Screens: Pressure laminate seamless face sheets to core material and provide continuous, interlocking molding strip or lapped and formed edges. Seal corners by welding or clips. Grind exposed welds smooth.
- C. Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Doors: Unless otherwise indicated, provide 24" wide in-swinging doors for standard toilet compartments and 36" wide out-swinging doors with a minimum 32" wide clear opening for compartments indicated to be handicapped accessible.
 - 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90°.
 - 2. Latch and Keeper: Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
 - 6. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

2.04 ZINC OR ZINC-ALLOY COATED STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying finishes.
- B. Color-Coated Finish: Provide manufacturer's standard baked finish complying with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.

1. Color: One color in each room as selected by University's Representative from manufacturer's full range of colors.

PART III - EXECUTION

3.01 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2" between pilasters and panels and not more than 1" between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
 1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.
- B. Floor-Anchored Compartments: Set pilaster units with anchors penetrating not less than 2" into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

3.02 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30° from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10155

SECTION 10265
IMPACT RESISTANT WALL PROTECTION

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Impact-Resistant Wall Protection including Wall guards, Handrails, Bed locators, Corner guards, Sheet and panel wall coverings, Kick and armor plates as shown and detailed on the Drawings and specified herein.
- B. Related Sections include the following:
 - 1. Division 5, Section 05500 – MISCELLANEOUS METAL FABRICATIONS for steel angle and bent plate corner guards fabricated from rolled metal.
 - 2. Division 6, Section 06100 – ROUGH CARPENTRY for wood blocking and grounds for surface-mounted wall guards, corner guards, and handrails.
 - 3. Division 8 – DOOR HARDWARE for stainless-steel mop, kick, armor, and push plates.

1.02 SUBMITTALS

- A. Product Data: Include physical characteristics, such as durability, resistance to fading, and flame resistance, for each impact-resistant wall protection system component indicated.
- B. Shop Drawings: Show locations, extent, and installation details of each impact-resistant wall protection system component. Show methods of attachment to adjoining construction.
- C. Samples for Review and approval: Provide a minimum of 2 samples from the manufacturer for each color and texture of wall or door protection specified.
- D. Omit this section

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed installation of impact-resistant wall protection system components similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing impact-resistant wall protection system components similar to those required for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain each color, grade, finish, and type of impact-resistant wall protection system component from a single source with resources to provide components of consistent quality in appearance and physical properties.

- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight-lines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection system and are based on the specific system indicated.
- F. Fire-Test-Response Characteristics: Provide impact-resistant wall protection system components with the following surface-burning characteristics, as determined by testing materials identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify impact-resistant wall protection system components with appropriate markings of applicable testing and inspecting agency.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 450 or less.
- G. Impact Strength: Provide impact-resistant wall protection system components with a minimum impact resistance of 25.4 ft.-lb./in. of width when tested according to ASTM D 256, Test Method A.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wall surface-protection system components until the space is enclosed and weatherproof and ambient temperature within the building is maintained at not less than 70°F for not less than 72 hours before beginning installation. Do not install rigid plastic wall surface-protection systems until that temperature has been attained and is stabilized.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacture for Hand Rails, Crash Rails, Corner Guards, Door and Wall Protection:
 - 1. InPro, Pawling, or equal.
- B. Bed Locators
 - 1. Specified as part of headwall system
 - a. Bed Locators will be Owner furnished Contractor installed

2.02 MATERIALS

- A. Extruded Rigid Plastic, Textured, chemical and stain-resistant, high-impact-resistant, PVC or acrylic-modified vinyl plastic; thickness as indicated with a minimum impact resistance of 25.4 ft. – lb./in. of width when tested according to ASTM D 256, Test Method A. .
 - 1. Color and Texture: As selected by University's Representative from manufacturer's standard full range of colors.
- B. Plastic Sheet Wall Covering Material: Semi-rigid, textured, chemical and stain-resistant, high-impact-resistant, PVC or acrylic-modified vinyl plastic sheet; thickness as indicated; with a minimum impact resistance of 25.4 ft.-lb./in. of width when tested according to ASTM D 256, Test Method A.
 - 1. Color and Texture: As selected by University's Representative from manufacturer's standard full range of colors.
- C. Aluminum Extrusions: Provide alloy and temper recommended by the manufacturer for the type of use and finish indicated, but with not less than the strength and durability properties specified in ASTM B 221 for alloy 6063-T5.
- D. Fasteners: Provide aluminum, nonmagnetic stainless-steel, or other non-corrosive metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.
- E. Adhesive: Non-flammable type recommended by the manufacturer for use with material on the substrate indicated.

2.03 WALL GUARDS

- A. Crash-Rail-Type Wall Guards: Nominal 6" high by 1" deep; heavy-duty assembly consisting of a snap-on-type rigid plastic cover installed over a continuous aluminum retainer mounted at height indicated.
 - 1. Cover: Extruded, rigid plastic, minimum 0.080" thick, in profile indicated.
 - 2. Retainer: Continuous, one-piece, extruded-aluminum retainer; minimum 0.080" thick; with continuous rubber or vinyl bumper cushion centered in the extrusion.
 - a. Mounting Type: Surface mounted flush on wall or as indicated on drawings.
 - b. Mounting Type: Extended mounting on high-impact mounting brackets.
 - 3. Accessories: Provide prefabricated, injection-molded end caps and inside and outside corners with concealed splices, cushions, mounting hardware, and other accessories as required.
 - a. End caps and inside and outside corners shall match plastic cover color and shall be field adjustable for close alignment with snap-on plastic covers.

- B. Bumper-Rail-Type Wall Guards: Continuous, snap-on-type plastic cover installed over a continuous aluminum retainer mounted at height indicated.
 - 1. Cover: Extruded, rigid plastic, minimum 0.080" thick or greater, in dimensions and profiles indicated.
 - 2. Retainer: Continuous, one-piece, extruded-aluminum retainer; minimum 0.080" thick.
 - a. Mounting Type: Surface mounted flush on wall or as indicated on drawings.
 - b. Mounting Type: Extended mounting on high-impact mounting brackets.
 - 3. Accessories: Provide prefabricated, injection-molded end caps and inside and outside corners with concealed splices, cushions, mounting hardware, and other accessories as required.
 - a. End caps and inside and outside corners shall match plastic cover color and shall be field adjustable for close alignment with snap-on plastic covers.

2.04 HANDRAILS

- A. Bumper-Rail-Type Handrails: 5 ½" high Impact-resistant, resilient handrail assembly consisting of a snap-on plastic cover installed over a continuous aluminum retainer mounted at height indicated. Comply with ANSI/CABO A117.1.
 - 1. Cover: Extruded, rigid plastic, minimum 0.080" thick, in dimensions and profiles indicated.
 - 2. Retainer: Continuous, one-piece, extruded-aluminum retainer; minimum 0.080" thick; with continuous rubber or vinyl bumper cushion centered in the extrusion.
 - 3. Mounting Bracket: Extended mounting on high-impact, prefabricated, injection-molded, plastic mounting brackets. Provide mounting hardware and other accessories as required.
 - 4. Accessories: Provide prefabricated, injection-molded end caps and inside and outside corners with concealed splices, cushions, and other accessories as required.
 - a. End caps and inside and outside corners shall match plastic cover color and shall be field adjustable for close alignment with snap-on plastic covers.

2.05 CORNER GUARDS

- A. Surface-Mounted, Resilient Plastic Corner Guards: Surface-mounted, resilient plastic corner-guard assembly consisting of a snap-on-type plastic cover installed over a continuous aluminum retainer, height as indicated.
- B. Flush-Mounted, Resilient Plastic Corner Guards: Height; from top of wall base to ceiling, flush-mounted, resilient plastic corner-guard assembly consisting of a snap-on-type plastic cover installed over a continuous aluminum retainer.

1. Cover: Extruded, rigid plastic, minimum 0.040" thick, in dimensions and profiles indicated.
 - a. Corner Radius: ¼".
 - b. Corner Radius: 1-¼".
 2. Retainer: Continuous, one-piece, extruded-aluminum retainer; minimum 0.062" thick.
 3. Accessories: Provide prefabricated, injection-molded top cap and aluminum base with concealed splices, cushions, mounting hardware, and other accessories as required.
 - a. Top caps shall match color of plastic covers and shall be field adjustable for close alignment with snap-on plastic covers.
- C. Stainless-Steel Corner Guards: Paper-covered, satin-finish, 0.0625" minimum, stainless-steel sheet corner guards; height as indicated. Provide 90° turn, unless otherwise indicated; and formed edges.

2.06 IMPACT-RESISTANT WALL COVERINGS

- A. Semi-rigid Sheet Wall Covering: Semi-rigid, embossed, fiber-backed, impact-resistant plastic sheets. Sheets shall comply with fire-test-response characteristics specified and be chemical and stain resistant. Provide manufacturer's standard; match moldings and trim as required.
1. Sheet Size: As indicated.
 2. Sheet Thickness: 0.080".

2.07 DOOR PROTECTION SYSTEMS

- A. Door Surface Protection: Protection plates; 0.060" thick minimum; fabricated from embossed, chemical and stain-resistant, extruded, rigid plastic with beveled edges; and complying with fire-test-response characteristics specified, ANSI/BHMA A156.6, and the following:
1. Kick Plate: 12" high by 1" less than door width.
 2. Armor Plate: 32" high by 1" less than door width.
 3. Push Plate: 16" high by 4" wide.
- B. Heavy Duty Door Edge Protector: Stainless steel, type 430, 16 gauge, U-shaped 90°
1. Strike side of door – height to underside of strike
 2. Hinge side of door – preferred full height with breaks at door hinges

2.08 FABRICATION

- A. General: Fabricate impact-resistant wall and door protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thickness' of components.
- B. Pre-assemble components in the shop to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnecting members to other construction.
- E. Provide inserts and other anchoring devices for connecting components to concrete or masonry. Fabricate anchoring devices to withstand imposed loads. Coordinate anchoring devices with the supporting structure.

2.09 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
 - 1. Color: As selected by University's Representative from the full range of industry colors and color densities.

2.11 STAINLESS-STEEL FINISHES

- A. Satin, Directional Polish: No. 6 finish.
 - 1. Remove tool and die marks and stretch lines or blend into finish.

2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions in which impact-resistant wall protection system components and impact-resistant wall covering materials will be installed.
 1. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Impact-Resistant Wall Covering Materials: Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

- A. Install impact-resistant wall protection system components level, plumb, and true to line without distortions.
 1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Install aluminum retainers, mounting brackets, and other accessories according to the manufacturer's written instructions.
 1. Where splices occur in horizontal runs of more than 20' (6.1 m), splice aluminum retainers and plastic covers at different locations along the run.

3.04 CLEANING

- A. General: Immediately on completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent. Clean metal components according to the manufacturer's written instructions.
- B. Remove excess adhesive using methods and materials recommended by the manufacturer.

END OF SECTION 10265

SECTION 10425
INTERIOR SIGNAGE AND EXTERIOR SPECIALTY SIGNS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all necessary services, labor, materials and product to fabricate and install all sign and /or graphic items included in the documents which consist of Design Drawings, Specifications, Signage Schedule and Location Plans.
- B. The UCDHS Sign Standards documents for Interior and Exterior Specialty signs are located at the end of this section. These Sign Standards include graphic standards, all sign types and specifications. The Sign Standards shall be followed unless directed otherwise by the University's Representative.
- C. Design Consultants shall be responsible to provide a floor and/or site plan that identifies code compliant sign requirements and location utilizing these campus standard sign types. (omit text- or approved MUTCD Regulatory Signs.)
- D. Design Consultants shall be responsible to provide a coded Signage Schedule identifying sign type, quantity, text and graphics required for each sign that correlates to the floor and/or site plans. (omit text -. In addition, the Design Consultants shall provide floor and/or site plans that correlate to the Signage Schedule.)
 - 1. Work specified in this section:
 - 1. Interior Signage

1.02 CONDITIONS AND GENERAL REQUIREMENTS

- A. Engineering and Code Requirements: For any sign located in the hospital and weighing over 20 pounds the Design Consultant or University's Representative shall provide an OSHPD approved attachment detail. The sign attachment needs to match the attachment detail exactly, no deviation will be allowed or the sign will need to be removed.

1.03 SUBMITTALS

- A. General:
 - 1. FOR ALL INTERIOR SIGN TYPES
 - 2. Refer to the Sign Standards, Section 5, Part 1.03, for instructions regarding signage submittals.
 - 3. Also, submit the following in accordance to the Conditions of the Contract and Division 1 Specification Sections.
 - 4. Submit all Submittals to the University's Representative unless directed otherwise by the University.
- B. Shop Drawings:

1. Sign Contractor to submit Shop Drawings that comply with the Sign Standards, Section 5, Appendix 1.03, Paragraph D.
 2. Reference approved attachment drawings if required.
 1. See Conditions and General Requirements, Section 1.02.
- C. Samples:
1. Sign Contractor to submit samples that comply with the Sign Standards, Section 5, Part 1.03, Paragraph E
 2. Item 3; Required Mock-ups

D. Product Data

1. Submit manufacturer's, fabricator's and finisher's specification, installation and maintenance instructions.

1.04 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.05 PROJECT CONDITIONS

- A. Verification of Existing Conditions and Documents: Sign Contractor shall visit the Site to inspect all existing conditions and to verify all dimensions which are related to the fabrication and/or installation of sign or graphic items. Sign Contractor shall thoroughly review these documents, checking conditions and dimensions shown. Notify University's Representative of any discrepancies in the documents. Written dimensions shall have precedence over scaled dimensions.

PART II - PRODUCTS

2.01 FINISHES

- A. Refer to Sign Specifications, Section 5, Part 2
- B. Surfaces of all items requiring a painted finish shall be properly prepared. Tool marks and other imperfections shall be filed and sanded or buffed. Surfaces must be cleaned before applying paint by removing chalk, dust, dirt, grease and oils. All pretreatment and primer provided in accordance with manufacturer's recommendation. Sufficient primer coats or undercoats shall be applied to achieve a smooth and uniform surface. All painted items shall be spray-painted in a dust free booth, following the paint manufacturer's recommendations concerning thinning and application. Apply additional coats when undercoats, stains or other conditions show through the color coat of paint, until paint is of uniform finish, color and appearance. All paint finishes must be allowed to dry and cure properly in sign shop, per manufacturer's instructions prior to graphic application and installation.
- C. Omit text for exterior signs

2.02 COPY

- A. Refer to Sign Standards, Section 5, Part 2, 2.02, Paragraph A, B, and C

2.03 MATERIALS

- A. Refer to Sign Standards, Section 5, Part 2, 2.03, Paragraph A thru K

2.04 PROJECT COLORS

- A. Colors: INTERIOR SIGNS

1. See Sign Standards, Section 2, Color Standards

2.05 TYPICAL SIGN TYPE

A. INTERIOR SIGN TYPES;

1. See Sign Standards, Section 3

PART III - EXECUTION

3.01 INSPECTION

- A. Refer to Sign Standards, Section 5, Part 3.01, Execution.
- B. For any sign in the hospital that weighs over 20 pounds and requires an OSHPD approved attachment detail an inspection or inspections will be required. The contractor will request the inspection with an Inspection Request as described in Division 1. Concealed attachment points should be inspected prior to the final signage materials being installed.

3.02 PREPARATION

- A. Refer to Sign Standards, Section 5, Part 3.02 Preparation

3.03 INSTALLATION

- A. Refer to Sign Standards, Section 5, Part 3.03 Installation
- B. Sign Installation: Shall be carried out in a neat and proper manner equal to the finest quality standards of the industry.
- C. Location Drawings: Shall be followed when installing signs and graphic items. Item numbers which are found in the Graphic Schedule identify specific sign units and their locations. Drawing show general location for each sign. Specific locations shall be determined by walking the Site with the University's Representative. Contractor shall post a coded water-resistant label at each sign location during walk-through.
- D. Installed Signs: Shall be clean, properly aligned, level and true to line and dimension, flush to surface or as detailed and specified, free of excess visible adhesive, if used. Damage to sign or surrounding surfaces or other imperfections will not be accepted. Any code required labels and shut-off switches to be on exterior of sign shall be concealed from normal viewing and all other labels shall be located inside the sign enclosure.
- E. Pin Fasteners: Where pins or other mechanical fasteners are used, also provide silicone or epoxy adhesive to prevent unauthorized removal of signs. All fasteners, structures and units must be structurally sound and comply with all applicable codes requirement and restrictions, including state seismic regulations.
- F. Protective Materials: Wrappers, covering, identifying stickers, paper etc., shall be removed from the sign at completion of installation.
- G. Any signage with an approved OSHPD attachment detail the installation of the sign must match the detail exactly. Any deviation from the approved attachment detail will not be tolerated and the sign or backing plate will need to be removed upon request at no additional cost to the University.

3.04 FINAL CORRECTIVE WORK

- A. Damage to signs or surrounding surfaces shall be repaired to the satisfaction of the University's Representative at no additional cost to the University.

3.05 CLEANING AND PROTECTION

- A. During the process of work, remove daily all discarded materials, rubbish, cans, rags, etc., from the Project site.
- B. Upon completion of paint work, clean or repaint all paint splattered signs and adjacent surfaces. Remove splattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At completion of installation, clean all sign surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by the University's Representative. Repair or replace damaged units as directed by the University's Representative at no additional cost to the University.
 - 1. Check all items for correct placement.
 - 2. Remove all packing material and debris from the site and leave premises in clean condition.
 - 3. Take special precautions to protect finishes.
 - 4. Clean sign material using only cleaners and methods in accordance with the manufacturer's instructions.

3.06 GUARANTEE

- A. All Product and Work shall be guaranteed for one (1) year from acceptance against cracking, crazing, peeling, blistering, delamination and other defects in material and/or workmanship.
- B. All vinyl shall be guaranteed for five (5) years.
- C. Furnish a one (1) year warranty, warranting that the paint finishes will not develop non-uniformity of color or fading and will not crack, peel, pit, corrode or otherwise fail as a result of defects in material or workmanship within the following defined limits. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the University.
 - 1. Fading: A change in appearance which is perceptible and objectionable as determined by the University's Representative when visually compared with the original color range standards.
 - 2. Non-Uniformity: Non-uniform fading to the extent that adjacent panels have a color difference greater than the original range of color.
 - 3. Will Not Pit or Otherwise Corrode: No pitting or other type of corrosion, discernible from a distance of 10', resulting from the natural elements in the atmosphere at the project site.

END OF SECTION 10425

SECTION 10520 FIRE EXTINGUISHERS AND CABINETS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section includes all materials and installation necessary to provide Fire Extinguishers and Cabinets, as shown and detailed on the drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 6, Section 06100 – ROUGH CARPENTRY

1.02 QUALITY ASSURANCE

- A. References:
 - 1. American National Standards Institute:
 - a. ANSI/NFPA 10: Portable Fire Extinguishers.
 - b. ANSI/UL 711: Rating and Fire Testing of Fire Extinguishers.
 - 2. National Fire Protection Association (NFPA): Standards.
 - 3. Underwriters Laboratories (UL): Standards for fire extinguishers.
- B. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience; manufacturer and approved.

1.03 SUBMITTALS

- A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Product Data: None required for specified products; required for alternate products.
- C. Certificates: Submit manufacturer's certificate stating that materials meet or exceed specified requirements.

1.04 PRODUCT HANDLING

- A. General: Refer to Section 01310 – COORDINATION.

1.05 SITE CONDITIONS

- A. Environmental Requirements: Do not install when temperatures may cause freezing of extinguisher ingredients.

1.06 MAINTENANCE

- A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES.

- B. Maintenance Data: Manufacturer's instructions.
- C. Guarantee: On form provided at end of Section 01780 – CLOSEOUT SUBMITTALS, provide one (1) year written guarantee commencing from date of final acceptance by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

- A. Manufacture:
 - 1. Amerex Corp.: Amerex Model #441 10lbs. 4A:60BC dry chemical fire extinguisher, or equal, no known equal; match existing hanger.
- B. Cabinets:
 - 1. Mounting: Recessed or semi recessed mounted. Refer to the Construction Documents for the type and location.
 - 2. Material and Finish:
 - a. General: White tub with red door and trim.
 - b. Size: 12" wide x 24" high x 8" deep.
 - c. Door Style: Door to be glass panel in metal frame. Latch is to be roller latch for in-door locations and lockable break glass for outdoor locations.
 - d. Glazing: Tempered glass; color as selected by University's Representative.
 - e. Lettering: Manufacturer's standard, horizontal; color as selected by University's Representative.
- C. Extinguishers:
 - 1. Extinguishers must have current service tag with monthly sign-off lines on reverse of tag.
 - 2. General: Fire fighting devices must be listed by Underwriters' Laboratories, Inc., bear a UL label, and be approved by the California State Fire Marshal.
- D. Fasteners: As recommended by manufacturer.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Section 01310 – COORDINATION.
- B. Examination: Examine conditions of work in place before beginning work; report defects.

3.02 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Cabinets: Where shown; anchor components firmly in place.
- C. Wall Brackets: Install as required by codes and regulations or as shown; anchor components firmly in place.
- D. Extinguishers:
 - 1. Cabinet: One (1) extinguisher for each cabinet.

3.03 FIELD QUALITY CONTROL

- A. Service: Inspect, charge and tag fire extinguishers not more than ten (10) days prior to occupancy of building by University's Representative.

3.04 ADJUSTMENT

- A. General: Prior to acceptance of cabinets, adjust moveable door parts to assure smooth operation.

3.05 CLEANING

- A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 10520

**SECTION 10800
ROOM ACCESSORIES**

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section includes all materials and installation for Room Accessories, as shown and detailed on the drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Division 5, Section 05410 – METAL STUD SYSTEM
 - 2. Division 6, Section 06100 – ROUGH CARPENTRY
 - 3. University furnished Contractor installed Room Accessories described in PART 2 – PRODUCTS.

1.02 QUALITY ASSURANCE

- A. References:
 - 1. American National Standard Institute (ANSI): ANSI 117.1 - Safety Standards for the Handicapped.

1.03 SUBMITTALS

- A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: If specifically requested.
- C. Product Data: None required for specified products; required for alternate products.

1.04 PRODUCT HANDLING

- A. General: Refer to Section 01310 – COORDINATION.

1.05 MAINTENANCE

- A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES
- B. Maintenance Data: Manufacturer's instructions.
- C. Guarantee: On form provided at end of Section 01780 – CLOSEOUT SUBMITTALS, provide one (1) year written guarantee commencing from date of final acceptance by University's Representative.

PART II - PRODUCTS

2.01 MATERIALS

A. General:

1. Bobrick Washroom Equipment, Inc., Gamco, or equal.
2. Finishes: Type 304 stainless steel; No. 4 satin finish, unless otherwise specified.
3. Templates and Backplates: Furnish to applicable trades as required for each accessory together with location and mounting height.

B. Accessories:

1. Mirrors:
 - a. General: Mirror glass per ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q1 mirror select, 1/4" thick; sizes as shown.
 - b. General: Stainless steel, with countersunk "theft proof" screws.
 - c. Frame: A Series; size TBD.
 - d. Backs: Resilient filler and galvanized steel backing plate, attach with "theft proof" concealed hangers.
2. Hand soap and Lotion Dispensers: Provided by University.
3. Roll Towel Dispenser: En Motion wall mount automated Towel Dispenser, Model No. 59462 – Black OR En Motion Impulse 10 Towel Dispenser, Model No. 59488 – Black, or equal (no known equal).
4. Waste Receptacles: Bodrick Product # BOB270, or equal, no known equal.
5. Grab Bars: Bodrick Heavy Duty Grab Bars; 18 gage 1-1/4" o.d. stainless steel tubing, Gamco, or equal.
6. Multi-roll Toilet Tissue Dispenser: Surface Mount, Tork Bath Tissue Dispenser Twin Mini Jumbo Roll, Model No. 55 55 290 – Black or equal (no known equal).
7. Recessed Toilet Seat Cover Dispensers: Hospeco Product #TSC1, Gamco, or equal.
8. Sanitary Napkin Dispenser: Bobrick B-3500, Gamco, or equal.
9. Sanitary Napkin Receptacle: Bodrick #B3500, Gamco, or equal.
10. Horizontal Wall-Mounted Baby Changing Station: Koala Kare (KB100-00 or KB100-01 or KB100-05 depending on color selection), or equal, no known equal. See manufacturer's specifications for product information and installation procedures.

C. Fasteners: As recommended by manufacturer; tamperproof type.

PART III - EXECUTION

3.01 PREPARATION

- A. General: Refer to Section 01310 – COORDINATION.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.

3.02 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Toilet Room Accessories: Install with concealed vandal-proof fasteners where mountings are made without back plates and where accessories are recessed or fastener is exposed to view. Where possible, mount accessories back-to-back. Attach accessories securely to walls as recommended by manufacturer for each item and each condition; adhesive installation not permitted.
- C. Grab Bars: Anchor grab bars to withstand minimum downward pull of 500 lbs. Secure grab bars to preset mounting plates screwed to studs, using brass or stainless steel vandal proof fastenings. Where mounted on toilet partitions, provide back-to-back sleeves per manufacturer's recommendations.
- D. University Furnished Items: Verify type and location of items furnished by University to ensure proper preparation for attachment to structure.

3.03 ADJUSTMENT

- A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

3.04 CLEANING

- A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 10800

SECTION 10801 TOILET AND BATH ACCESSORIES

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Toilet and Bath accessories as shown and detailed on the Drawings and specified herein, including:
 - 1. Warm-air dryers
 - 2. Infant-care products
 - 3. Under lavatory guards
- B. Related Sections include the following:
 - 1. Division 10, Section 10155 – TOILET COMPARTMENTS for compartments and screens.

1.02 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Samples: For each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.
- E. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by University's Representative.

1.04 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

- B. Coordinate delivery inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. ,Or equal.

PART III - EXECUTION Not Applicable to this Section

END OF SECTION 10801

SECTION 11610 LABORATORY EQUIPMENT

PART I – FUME HOODS

A. General Fume Hood Requirements

1. Quality Assurance - Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section.
 - a. Abbreviations noted below:
California Electric Code (CEC) – most current publication
National Fire Protection Association (NFPA) – most current publication
 - b. NFPA 45 - Standard on fire protection for laboratories using chemicals. Chapter 6: Ventilating System, Chapter 9-2.8: Laboratory Hoods.
 - c. NFPA 56C - Safety standard for laboratories in health-related institutions, chapter 3-3.5: Fume hoods.
 - d. Underwriters Laboratories (UL) – most current publication
2. Requirements of Regulatory Agencies
 - a. Prior approval from University of California Davis Environmental Health & Safety (UCDEH&S) for any substitution is required.
 - b. Work shall be governed by State of California, California Code of Regulations (CCR) Title 8, Industrial Relations and Title 24, State Building Standard.
 - c. Electrical work shall conform to California Electrical Code as minimum standard.
 - d. Flammable liquid storage cabinets shall conform to standards and methods of University of California Davis Fire Department's Fire Prevention Bureau (UCDFPB) for certification of such cabinets, and NFPA Pamphlet #30.
3. Fume Hood Design Standards
 - a. SAMA Fume Hood Standards - LF-10, latest edition.
 - b. ASHRAE Current Applications: Chapter 14 - Laboratories: Part VIII: Laboratory Fume Hoods - American Society of Heating, Refrigerating, and Air Conditioning Engineers.
 - c. Guidelines for Construction and Equipment of Hospital and Medical Facilities - U.S. Department of Health and Human Services; Chapter 7.29 Mechanical Standards - Sections D(1)(n): Laboratory Hood Special Standards.
 - d. USDA: Science and Educational Administration Manual for Laboratory Chemical Fume Hoods - Standards - United States Department of Agriculture.
4. Submittals
 - a. Only those fume hoods on the University's approved list may be used. Fume hood submittals must be reviewed and approved by UCDCM EH&S, FD&C and PO&M prior to selection.

- b. Fume hoods not on the University's approved list may be added to the approved list only after UCDMC EH&S, FD&C and PO&M review and approval of manufacturer's specifications.
- c. Manufacturer's product literature and data sheets.
- d. Plastic laminate for color selection.
- e. Submit specifications for size of fume hood, showing dimensions, required clearances, and finishes; and where necessary, size (especially height above floor), and capacity and location of all mechanical and electrical services required.
- f. Certificates: Certify compliance with UCDFPB requirements for under hood flammable liquid storage cabinets.

5. Testing

- a. Balance, test, and certify each fume hood in accordance with the latest edition of ASHRAE 110 Testing Requirements. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity, containment and air flow patterns.
- b. Fume hood face velocity to be maintained at between 100-120 fpm at all times during normal operation.
- c. As installed, under the ASHRAE 110 test method, fume hoods must meet the testing criteria 4.0A10.05 as specified in the Industrial Ventilation Handbook (4.0 liters/minute release rate of tracer gas, as-installed, less than 0.05 ppm of tracer gas detected by the mannequin).
- d. There shall be no visible smoke flow out of the fume hood during the flow visualization test.
- e. Balance, test, and certify each glove box in accordance with the latest edition of NSF 49 Testing Requirements. Glove box field tests shall be performed by a qualified independent testing company on each glove box to determine proper containment. Glove boxes to be maintained at a negative air pressure of at least 0.50 inches w.g.

6. General Design Issues

- 1) Fume hoods are to be operated 24 hours a day. No user controlled shut-off switch is allowed.
- 2) Fume hoods may be ganged together if materials used are compatible in all hoods and meet National Fire Protection Association (NFPA) and other regulatory requirements.
- 3) Perchloric acid and other hot acid digestion hoods must be on a dedicated system and have an automatic wash down system. High use solvent extraction and solvent use hoods (ether, other flammable solvents, etc.) must be on dedicated system.
- 4) Full by-pass fume hoods must be used for constant volume applications (no variable air volume system exists). Variable air volume (VAV) hoods (partial by-pass) must be used in conjunction with a VAV general ventilation system (i.e. Phoenix Controls, or equal). Refer to Section 15900 Lab VAV Controls.

B. Chemical Fume Hoods

1. General Product Requirements

- a. All chemical fume hoods must meet UCDMC EH&S, FD&C and PO&M approval. The following chemical fume hood manufacturers currently approved for UCD are: Fisher/Hamilton, Kewaunee, Jamestown, Mott

- Manufacturing, and H.H. Hawkins Ltd. Manufacturer's specifications for specific model types shall be submitted to UCDEH&S for pre-approval.
- b. Must be in commercial production and usage for a minimum of 5 years.
 - c. Must be tested using most current American National Standards Institute (ANSI)/ASHRAE 110 method.
 - d. Ductless or auxiliary air hoods are not acceptable.
 - e. No operator adjustable baffles, removable fixed slot or perforated baffles only. Slots are to be continuous across the back of the fume hood.
 - f. Noise generated by the functioning hood within 6 inches of the plane of the sash and by-pass opening in any position shall not exceed 60 dBA.
 - g. Full by-pass constant volume hood or partial by-pass variable air volume (VAV) hood. VAV fume hoods must meet the criteria of this section and section 15900 Laboratory VAV (Variable Air Volume) Control Systems.
 - h. Under fume hood storage cabinets:
 - (1) Flammable liquid storage cabinets may be ventilated. Cabinets used for flammable liquid storage must not be vented directly into the fume hood. Ventilated cabinets may be exhausted into fume hood exhaust above the fume hood damper or exhausted separately.
 - (2) Acid/corrosive storage cabinets do not require venting. If acid/corrosive storage cabinet is vented, it must be separate from the fume hood exhaust. The vent may be connected at the point where the fume hood exhaust duct enters the general fume hood exhaust manifold.

2. Materials

a. Fume hood Construction

- (1) Fume hood shall be constructed of materials compatible with intended usage, e.g. type 316 stainless steel, polyresin, etc.
 - a) Removable baffles with three fixed slots or engineered perforations.
 - b) Air Foil that provides an air sweep across the work surface with the sash in the fully lowered position. Air foils installed over the work surface edge, allowing for air flow under the air foil are preferred.
 - c) Interior end panels require an access panel with gas tight gasket.

b. Sash

- (1) Vertical type: ¼" thick laminated safety glass complete with ¼" deep stainless steel metal channels on sides, top and bottom; or frameless.
 - a) Combination sashes must be pre-approved by UCDEH&S.
- (2) Mechanical stops to ensure that sash work opening is 18", as measured from the top of the fume hood work surface to the bottom of the sash.
- (3) A manual override to allow the vertical sash to be raised above the maximum opening to allow lab apparatus to be installed or removed.
- (4) Operating face velocity at 18" shall be set between 100-120 fpm.

c. Fume hood Air Flow Indicator/Alarm

Provide an airflow alarm. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:

- (1) The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity drops below 90 fpm or rises above 125 fpm. Audible alarm shall pulse at 80 dbA.
- (2) The monitor shall be UL listed, with all alarm circuit electric components, external tubing, restrictors, and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
- (3) Alarm Signal. Audible pulsating signal and a visual, flashing red large light emitting diode.
 - a) Silence push button, which temporarily overrides the audible alarm for a period no longer than 5 minutes, shall be accessible on the front of the Safety Monitor. Note: Teaching laboratory hood alarm override shall not exceed a one-minute period. Once the "unsafe" operating condition has been corrected, the audio alarm shall automatically reset.
 - b) During temporary silence of audible alarm the visual alarm remains activated until the alarm condition is corrected.
 - c) It shall not be possible to routinely disable the alarm signal. Locate electrical outlet on top of hood.
 - d) When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically reset and begin routine monitoring.
- (4) Test circuit will be provided to verify proper Safety Monitor operation.
- (5) Electrical Rating: Maximum 15VDC and maximum current rating of 200 MA.
- (6) An air monitor or alarm, comparable to ALNOR Airgard 405, or equal is acceptable.
- (7) Connect between fume hood and the filter or damper.
- (8) Flow tube device (floating indicators) or ribbons hanging in the air stream are not acceptable airflow indicators.

d. Electrical Items

- (1) Receptacles per National Electrical Manufacturers Association (NEMA) 5-15R: 15A-125VAC three-wire duplex polarized receptacles. Same as Harvey Hubbel-Inc.'s No. 5252, Arrow-Hart, Leviton, or equal. Receptacles shall be GFI.
- (2) Plate Covers: Meet usage, UCDCMC Standard is Bell or equal.
- (3) Switch for lighting: UCDCMC Standard is Hubbel #1221 or equal.
- (4) Flexible Conduit: 1/2" complete with wiring as required.
- (5) Light Fixture: Heavy-duty fluorescent strip light with 430 Ma rapid-start lamps and 120-volt HPF ballasts. Provide three-foot length for four-foot hoods, and four-foot for six-foot hoods. Same as Garcy #RN 9942- 36H; Columbia Lighting, Inc.; Smoot-Holman Company; Benjamin Products of Thomas Industries, Inc.; or equal (all units must be vapor proof lighting).
- (6) Shall be accessible for service from outside the hood.
- (7) No fan switch at the fume hood.

e. Work Surface

- (1) The work surface shall have a raised lip on all four sides, and be constructed of materials compatible with usage. Union between work surface and counter shall be coved at a $\frac{3}{4}$ " radius and sealed watertight.

f. Cup Sink

- (1) Flush with work surface and conforming to usage requirements, complete with stainless steel tailpiece as required.

g. Duct Work

- (1) Materials shall be compatible with intended usage.
- (2) Include trim damper in duct above ceiling.
- (3) Outlet shall be 12" round or square-to-round transition provided.

h. Utilities (gas, air, water, steam, and vacuum)

- (1) Make provisions for cold water only for each hood, in accordance with utility service symbols. Provide vacuum breaker, required at each fume hood outlet, in addition to main backflow preventer.
- (2) Run internal electric wiring in conduit. Do not run conduit through hood interior or across hood front.
- (3) Utilities controls shall be located outside of hood interior for convenient access and use.
- (4) Fixtures shall be Water Saver Faucet Company, Chicago Faucet, T & S, or equal. The following specifications refer to Water Saver Faucet Company to establish quality, utility, and appearances.
 - a) Gas, air, water, steam, and vacuum fixtures shall be made up of remote control valves L-3185 ($\frac{1}{2}$ " IPS inlet pipe thread, $\frac{3}{8}$ " NNPT outlet pipe threads) with guide bushing "B" with 4-arm handle and color plastic index disc, for service specified.
 - b) For gas, air, and vacuum, the remote control valve shall be connected to a Water Saver L-14 (or equal) serrated nozzle with $\frac{3}{8}$ " male threads, 10 serrations, and of dimensions as shown on drawing. Valve shall have stainless steel seat and stainless steel renewable floating cone unit.
 - c) For water, the remote control valve shall be connected to a Water Saver L171-WSA with vacuum breaker (or equal) serrated nozzle with a $\frac{1}{2}$ " pipe and elbow. Valves shall have "Water Saver: standardized renewable operating unit."
 - d) Access panel to service utilities shall be gasketed with approved gasket material.
 - e) Do not run plumbing through hood interior or across front of hood.
 - (f) Water faucet shall have vacuum breaker.
 - (g) Pre-plumb all utilities.
 - (i) Exterior Construction
 - (1) Chemical resistant finish.

- (2) End panels fastened to frame with screws.
- (3) Unused holes (interior or exterior) shall be plugged or blanked.

C. Acid Fume Hoods

1. General Product Requirements for Acid Fume hoods (Perchloric, other hot inorganic acid digestions, etc.). Shall conform to NFPA 45. Note: refer to general requirements section for chemical fume hoods in previous section.
 - a. Pre-approved by UCDEH&S.
 - b. Must be in commercial production and usage for a minimum of five years.
 - c. Noise generated by the functioning hood within 6" of the plane of the sash in any position shall not exceed 60 dBA.
 - d. Constant volume hood with by-pass feature.
 - e. Under fume hood storage cabinets:
 - (1) Flammable liquid storage cabinets are not approved for installation under acid fume hoods.
 - (2) Acid storage cabinets are approved for under fume hood storage. Do not vent into acid fume hood exhaust system.
2. Materials
 - a. Fume hood Construction
 - (1) Fume hood shall be constructed of stainless steel type 316 with welded joints or unplasticized polyvinyl chloride (PVC). A PVC liner or inorganic ceramic coating, such as porcelain may be specified, providing it is compatible with the chemicals to be used.
 - a) Removable baffles with three fixed slots, no adjustable baffles.
 - b) Wash Down System - shall thoroughly wash in sequence from the exhaust stack, fan, exhaust duct and behind fume hood baffles.
 - c) Air foil that provides an air sweep across the work surface with the sash in the fully lowered position. Air foils installed over the work surface edge, allowing for air flow under the air foil are optimum.
 - (2) Pre-wire all items.
 - b. Sash
 - (1) Vertical type: ¼" thick laminated safety glass complete with ¼" deep stainless steel metal channels on sides, top and bottom. Some specialty acid hoods (i.e., hydrofluoric acid) may require a Lexan or similar sash. Contact EH&S and User Group for more information.
 - a) No combination sash allowed.
 - b) Bypass.
 - (2) Mechanical stops to ensure that sash work opening is 18", as measured from the top of the fume hood work surface to the bottom of the sash.
 - (3) A manual override to allow the vertical sash to be raised above the maximum opening to allow lab apparatus to be installed or removed.
 - (4) Operating face velocity at 18" shall be between 100-120 fpm.

- c. Glass
 - (1) Panels: ¼" thick laminated safety glass complete with ¼" deep metal channels on sides and bottom compatible with usage.
 - (2) Light Opening: ¼" thick safety glass in rubber channels within metal frame.

- d. Fume hood Air Flow Indicator/Alarm

Provide an airflow alarm. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:

 - (1) The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity drops below 90 fpm or rises above 125 fpm. Audible alarm shall pulse at 80 dbA.
 - (2) The monitor shall be UL listed, with all alarm circuit electric components, external tubing, restrictors, and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
 - (3) Alarm Signal. Audible pulsating signal and a visual, flashing red large light emitting diode.
 - a) Silence push button, which temporarily overrides the audible alarm for a period no longer than 5 minutes, shall be accessible on the front of the Safety Monitor. Note: Teaching laboratory hood alarm override shall not exceed a one-minute period. Once the "unsafe" operating condition has been corrected, the audio alarm shall automatically reset.
 - b) During temporary silence of audible alarm the visual alarm remains activated until the alarm condition is corrected.
 - c) It shall not be possible to routinely disable the alarm signal. Locate electrical outlet on top of hood.
 - d) When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically reset and begin routine monitoring.
 - (4) Test circuit will be provided to verify proper Safety Monitor operation.
 - (5) Electrical Rating: Maximum 15VDC and maximum current rating of 200 MA.
 - (6) An air monitor or alarm, comparable to ALNOR Airgard 405, or equal is acceptable.
 - (7) Connect between fume hood and the filter or damper.
 - (8) Flow tube device (floating indicators) or ribbons hanging in the air stream are not acceptable airflow indicators.

- e. Electrical Items
 - (1) Receptacles per NEMA 5-15R: 15A-125VAC three-wire duplex polarized receptacles. Same as Harvey Hubbel-Inc.'s No. 5252, Arrow-Hart, Leviton, or equal. Receptacles shall be GFI.
 - (2) Plate Covers: Meet usage, UCDMC Standard is Bell or equal.
 - (3) Switch for lighting: UCDMC Standard is Hubbel #1221 or equal.
 - (4) Flexible Conduit: ½" complete with wiring as required.
 - (5) Light Fixture: Heavy-duty fluorescent strip light with 430 Ma rapid- start lamps and 120-volt HPF ballasts. Provide three-foot length for four- foot hoods, and four-foot for six-foot hoods. Same as Garco #RN 9942- 36H; Columbia Lighting, Inc.; Smoot-

- Holman Company; Benjamin Products of Thomas Industries, Inc.; or equal (all units must be vapor proof lighting).
 - (6) Shall be accessible for service from outside the hood.
 - (7) No fan switch at the fume hood.
 - f. Work Surface
 - (1) The work surface shall have a raised lip on all 4 sides, and be constructed of materials to meet usage. Union between work surface and counter shall be coved at a $\frac{3}{4}$ " radius and watertight.
 - g. Duct Work
 - (1) Materials shall be non-reactive, acid resistant and compatible with intended usage.
 - h. Use only acid-resistant metallic fan protected by an inorganic coating.
 - i. Cup Sink
 - (1) Flush with work surface and conforming to usage requirements, complete with stainless steel tailpiece as required.
- 3. Fabrication
 - a. Shop fabricates and assembly complete units insofar as dimensions permit shipment and installations.
 - b. Fume hood Assembly
 - (1) Assemble hood with continuous welding of all metal-to-metal joints.
 - (2) Grind joints round so that all surfaces are smooth ($\frac{3}{4}$ " radius), or glass fiber reinforced fire retardant polyester resin one-piece molded hood chamber completely seamless and crevice free. Basin is to be an integral part of the chamber.
 - c. Utilities
 - (1) Make provisions for cold water only for each hood, in accordance with utility service symbols. Fixture must be provided with a vacuum breaker.
 - (2) Run internal electric wiring in conduit. Do not run conduit through hood interior or across hood front.
 - (3) Utilities controls shall be located outside of hood interior for convenient access and use.
 - (4) Fixtures shall be Water Saver Faucet Company, Chicago Faucet, T & S, or equal. The following specifications refer to Water Saver Faucet Company to establish quality, utility, and appearances.
 - a) Gas, air, water, steam, and vacuum fixtures shall be made up of remote control valves L-3185 ($\frac{1}{2}$ " IPS inlet pipe thread, $\frac{3}{8}$ " NNPT outlet pipe threads) with guide bushing "B" with 4-arm handle and color plastic index disc, for service specified.
 - b) For gas, air, and vacuum, the remote control valve shall be connected to a Water Saver L-14 (or equal) serrated nozzle with $\frac{3}{8}$ " male threads, 10 serrations, and of dimensions as shown on drawing. Valve shall have stainless steel seat and stainless steel renewable floating cone unit.

- c) For water, the remote control valve shall be connected to a Water Saver L171-WSA with vacuum breaker (or equal) serrated nozzle with a ½" pipe and elbow. Valves shall have "Water Saver: standardized renewable operating unit"
- d) Access panel to service utilities shall be gasketed with approved gasket material.
- e) Do not run plumbing through hood interior or across front of hood.
- f) Pre-plumb all utilities.
- g) Water faucet shall have vacuum breaker.

4. Testing

- a. Balance, test, and certify each fume hood in accordance with the latest edition of ASHRAE 110 Testing Requirements. A qualified independent testing company shall perform fume hood field tests on each hood.

PART II – BIOLOGICAL SAFETY CABINETS

- 1. All biological safety cabinets shall meet the specifications within the most recent edition of the National Sanitation Standard 49 – Class II (Laminar Flow) Biohazard Cabinetry.
- 2. All biological safety cabinets must meet the campus' review team approval. The following biological safety cabinet manufacturers are currently approved for campus: Baker, Nu-Aire, and Forma. Manufacturer's specifications for specific model types shall be submitted to UCDMC EH&S for pre-approval.
 - a. Biosafety cabinet face velocity shall be maintained at no less than 100 fpm at all times during operation.
 - b. Each cabinet shall be equipped with one front mounted magnahelic gauge indicating the differential pressure across the filter.
 - c. The noise level as measured 12" in front of the cabinet and 15" above the work surface shall not exceed 67 dBA.
 - d. All biosafety cabinets must be tested per National Sanitation Foundation (NSF) Standard 49 or manufacturer's specifications after installation. The University's Representative should forward the testing results to UCDEH&S for review.
- 3. Classes and types of Biological Safety Cabinets are listed below:
 - a. Class II Type A1 cabinets (formerly designated Type A)
 - (1) Maintain minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening;
 - (2) Have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common plenum (i.e., a plenum from which a portion of the air is exhausted from the cabinet and the remainder supplied to the work area);
 - (3) May exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy; and
 - (4) May have positive pressure contaminated ducts and plenums that are not surrounded by negative pressure plenums.
 - (5) Type A1 cabinets are not suitable for work with volatile toxic chemicals and volatile radionuclides.
 - b. Class II, Type A2 Cabinets (formerly designated Type B3)

- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening;
 - (2) Have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common exhaust plenum;
 - (3) May exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy; and
 - (4) Have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.
 - (5) Type A2 cabinets used for work with minute quantities of volatile toxic chemicals and tracer amounts of radionuclides required as an adjunct to microbiological studies must be exhausted through properly functioning exhaust canopies.
- c. Class II, Type B1 Cabinets
- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening;
 - (2) Have HEPA filtered downflow air composed largely of uncontaminated recirculated inflow air;
 - (3) Exhaust most of the contaminated downflow air through a dedicated duct exhausted to the atmosphere after passing through a HEPA filter; and
 - (4) Have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.
 - (5) Type B1 cabinets may be used for work treated with minute quantities of volatile toxic chemicals and tracer amounts of radionuclides required as an adjunct to microbiological studies if work is done in the direct exhausted portion of the cabinet, or if the chemicals or radionuclides will not interfere with the work when recirculated in the downflow air.
- d. Class II, Type B2 Cabinets (sometimes referred to as "total exhaust")
- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening;
 - (2) Have HEPA filtered downflow air drawn from the laboratory or the outside air (i.e., downflow air is not recirculated from the cabinet exhaust air);
 - (3) Exhaust all inflow and downflow air into the atmosphere after filtration through a HEPA filter without recirculation in the cabinet or return to the laboratory; and
 - (4) Have all contaminated ducts and plenums under negative pressure or surrounded by directly exhausted (nonrecirculated through the work area) negative pressure ducts and plenums.
 - (5) Type B2 cabinets may be used for work with volatile toxic chemicals and radionuclides required as adjuncts to microbiological studies.
- e. Class III Cabinets
- (1) A totally enclosed, ventilated cabinet of leak-tight construction. Operations in the cabinet are conducted through attached rubber gloves. The cabinet is maintained under negative air pressure of at least 0.50 in. w.g. (120 Pa). Downflow air is drawn into the cabinet through HEPA filters. The exhaust air is treated by double HEPA filtration or by HEPA filtration and incineration.

PART III – LABORATORY EMERGENCY EYEWASH/SHOWER

Emergency eye or eye/face wash equipment shall be provided in all work areas where, during routine operations or foreseeable emergencies, the eyes of an employee may come in contact with a substance which can cause corrosion, severe irritation or permanent tissue damage or which is toxic by absorption. This equipment must meet the performance and installation requirements of American National Standards Institute (ANSI) Z358.1 1998. UCDEH&S will make final determination on selection of equipment to ensure the equipment meets this standard.

A. LOCATION OF EQUIPMENT

All laboratories that use substances described above must have at least one emergency eye or eye/face wash located within the laboratory and as close as possible to the hazard. A combination eyewash/emergency shower shall be located within a research laboratory using hazardous chemicals as described above; or a combination eyewash/emergency shower may be located outside the laboratory provided an approved eyewash is located in the laboratory. The combination unit must be located so that travel distance is no more than 10 seconds or 100 feet with no obstructions and only one door to pass through to reach the unit.

Hand held drench hoses are not considered eyewash units. They may be used in addition to equipment, which is described as meeting the ANSI standard above. In some cases, a sink-mounted eyewash and a drench hose may be installed in lieu of a combination eyewash/safety shower. Consult UCD EH&S for review and approval of this configuration.

B. EMERGENCY EYE WASH AND SHOWERS

The approved units must be:

1. Supplied by domestic water.
2. Readily visible and accessible to the laboratory or work site. The unit should be located as close to the hazard as possible and cannot be blocked by building structures, cabinets, supplies or equipment.
3. Provided with an activation device, such as stay open ball valve, that allows the user full movement of both hands after the valve is turned on.
4. Identified with a highly visible sign.
5. Drain will be plumbed to sanitary sewer.
6. Located so as not to pose an electrical shock hazard. No electrical outlets within 6 feet unless GFI protected.
7. Indoor units are not required to deliver tempered water. Units installed outdoors or in adverse climates may need to be tempered. The need for tempered water shall be reviewed and approved by University of California Davis Environmental Health & Safety (UCDEH&S) during the design phase.

C. EMERGENCY EYE WASH

Approved emergency eye or eye/face wash units are Haws 7611 or Guardian G1805 (laboratory unit – install at sink), Haws 7000BT or Guardian G1750PT (Barrier Free), Haws 7656WC or Guardian GBF 1735DP (recessed), or equal. In addition to the requirements above, the approved units must be:

1. Regulated to provide a spray force of three to six gallons per minute at 30 psi.
2. Mounted such that the water nozzles are 33 inches to 45 inches from the floor level; height should comply with Americans with Disabilities Act of 1990 (ADA) requirements.

3. Mounted so that spray nozzles, when activated, are no more than 18 inches from the counter front when located above work counters or benches.
4. Drain will be plumbed to sanitary sewer.

D. EMERGENCY SHOWERS

The unit must be installed and located so both the shower and eyewash can be used at the same time by one person. Approved eyewash/emergency shower units are Haws 8346 or Guardian G1909 HFC (GBF1909 Barrier Free), Haws 8355WC (recessed), Guardian GBF2150 (recessed), or equal. Eyewash component must meet the requirements for Emergency Eye Wash above. In addition to the requirements above, the approved units must be:

1. Adequately supplied with potable water to meet the requirements of each component. The shower must be able to deliver 20 gallons per minute. The diameter of the water pattern of the shower measured 60 inches above the surface on which the user stands must be a minimum of 20 inches. The center of the spray pattern shall be located at least 16 inches from any obstruction.
2. Supplied by a minimum pipe size of 1-¼ inches.
3. Installed so that the shower head is not less than 82 inches nor more than 96 inches from the surface on which the user stands.
4. Shower component activated yearly to verify proper operation.

END OF SECTION 11610

SECTION 12347
METAL LABORATORY CASEWORK

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope: Work under this Section shall include all materials and installation necessary to provide Metal Laboratory Casework including standard metal laboratory casework, metal laboratory casework and support-framing system, laboratory utility-space framing, laboratory countertops, laboratory sinks, accessories, water, laboratory gas, and electrical service fittings as shown and detailed on the Drawings and specified herein.
- B. Related Sections include the following:
 - 1. Division 6 – Rough Carpentry for wood blocking for anchoring laboratory casework.
 - 2. Division 9 – Resilient Wall Base and Accessories for resilient base applied to metal laboratory casework.
 - 3. Division 11 – Laboratory Fume Hoods for fume hoods.
 - 4. Division 15 and 16 for installing service fittings specified in this Section.
 - 5. Division 15 and 16 connecting service utilities at indicated point. Piping and wiring for service fittings within casework up to point of connection are specified in this Section.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal laboratory casework capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of drawers and doors:
 - 1. Shelves of Base, Wall, and Storage Cabinets: 100 lb (45 kg).
 - 2. Drawers: 150 lb (68 kg).
 - 3. Wall Cabinets: 75 lb/ft. (112 kg/m).
 - 4. Suspended-Base Cabinets: 75 lb/ft. (112 kg/m).
 - 5. Floor-Supported Base Cabinets: 75 lb/ft. (112 kg/m) within cabinets, 50-lb/ft. (74-kg/m) countertop, plus 75 lb/ft. (112 kg/m) on countertop.
 - 6. Countertop Supports: 50-lb/ft. (74-kg/m) countertop, plus 75 lb/ft. (112 kg/m) on countertop.
 - 7. Support Framing: 300 lb/ft. (446 kg/m) for single-faced assemblies, 600 lb/ft. (893 kg/m) for back-to-back assemblies.

- B. Seismic Performance: Provide metal laboratory casework system capable of withstanding the effects of earthquake motions determined according to the building code in effect for this Project.

1.03 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For metal laboratory casework. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate locations of blocking and other supports required for installing casework.
 - 2. Indicate locations and types of service fittings, together with associated service supply connection required.
 - 3. Include details of utility spaces showing supports for conduits and piping.
 - 4. Include details of support-framing system.
 - 5. Include details of exposed conduits, where required for service fittings.
 - 6. Show adjacent walls, doors, windows, other building components, and other laboratory equipment. Indicate clearances from above items.
 - 7. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for cabinets and each type of top material indicated.
- D. Samples for Verification: 6" (150-mm) square samples for each type of finish, including top material.
- E. Samples for Verification: As follows:
 - 1. 6" (150-mm) square samples for each type of top material.
 - 2. One full-size, finished base cabinet complete with hardware, doors, and drawers, but without countertop.
 - 3. One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.
 - 4. One sample each of hinged and sliding doors.
 - 5. One of each service fitting specified, complete with accessories and specified finish.
 - 6. One of each type of sink and accessory item specified.
 - 7. Maintain Samples at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise directed, approved Sample units in an undisturbed condition at the time of Substantial

Completion may become part of the completed Work. Notify University's Representative of their exact locations. If not incorporated into the Work, retain acceptable Sample units at Project site and remove when directed by University's Representative.

- F. Product Test Reports: Based on tests performed by a qualified independent testing agency, indicate compliance of laboratory casework finishes and countertops with requirements specified for chemical and physical resistance.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 548.
- B. Source Limitations: Obtain laboratory casework, including tops, sinks, service fittings, and accessories, through one source from a single manufacturer.
- C. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with the requirements of NFPA 30 for design, construction, and capacity of storage cabinets by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver laboratory casework until painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions" Article below.
- B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels through remainder of construction period.

1.07 COORDINATION

- A. Coordinate layout and installation of metal framing and reinforcement in gypsum board assemblies for support of metal laboratory casework.

PART II - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Laboratory Casework:

- a. Fisher Hamilton Scientific, Inc.
 - b. Kewaunee Scientific Corp.; Laboratory Division.
 - c. Or equal.
2. Epoxy Tops, Sinks, and Troughs:
 - a. Durcon Company, Inc. (The).
 - b. Laboratory Tops, Inc.
 - c. Or equal.
3. Phenolic-Composite Tops:
 - a. Hoechst Celanese Corp.
 - b. H.T.C., Incorporated.
 - c. Or equal.
4. Chemical-Resistant Plastic Laminates:
 - a. Formica Corporation.
 - b. Pioneer Plastics Corp.
 - c. Ralph Wilson Plastics Co.
 - d. Or equal.

2.02 MATERIALS

- A. Metal: Commercial-quality, cold-rolled, carbon-steel sheet, complying with ASTM A 366 (ASTM A 366M); matte finish; suitable for exposed applications; and stretcher leveled or roller leveled to stretcher-leveled flatness.
- B. Minimum Metal Thickness: Provide metal laboratory furniture components of the following minimum thicknesses:
 1. Sides, ends, fixed backs, bottoms, tops, soffits, and items not otherwise indicated: 0.0478" (1.2 mm). Except for flammable liquid storage cabinets, bottoms may be 0.0359" (0.9 mm) if reinforced.
 2. Back panels, doors, drawer fronts and bodies, and shelves: 0.0359" (0.9 mm). For back panels and doors for flammable storage cabinets, use 0.0478" (1.2-mm) thick metal. For shelves more than 36" (900 mm) long, use 0.0478" (1.2-mm) thick metal or provide suitable reinforcement.
 3. Intermediate horizontal rails, table aprons and cross rails, center posts, and top gussets: 0.0598" (1.5 mm).
 4. Drawer runners, sink supports, and hinge reinforcements: 0.0747" (1.9 mm).

- 5. Leveling and corner gussets: 0.1046" (2.7 mm).
- C. Acid Storage-Cabinet Lining: ¼" (6-mm) thick, glass-fiber cement board complying with ASTM C 1186.
- D. Acid Storage-Cabinet Lining: ¼" (6-mm) thick, polypropylene, epoxy, or phenolic-composite lining material.
- E. Clear Tempered Glass for Glazed Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 5.5 mm thick.

2.03 FABRICATION

- A. General: Complete assembly and finish work at point of manufacture. Perform assembly on precision jigs to provide units which are square; fully reinforced with angles, gussets, and channels; and integrally framed and welded to form a dirt and vermin-retardant enclosure. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16" to 3/32" (1.5 to 2.4 mm).
- B. Fabricate units on precision dies for interchangeability of like-size drawers, doors, and similar parts.
- C. Flush Doors: Outer and inner pans formed and telescoped into box formation, with channel reinforcements full height on center of each pan. Fill doors solid with noncombustible, sound-deadening material.
- D. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.
- E. Hinged Doors: Mortise at flanges for hinges and reinforce with angles, welded inside inner pans at hinge edge.
- F. Drawers: Assemble fronts from telescoping outer and inner pans, designed to eliminate raw edge of steel at top. Fabricate sides, back, and bottom of one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Weld drawer front to sides, back, and bottom to form a single, integral unit. Provide drawers with rubber bumpers, runners, and positive stops to prevent metal-to-metal contact or accidental removal.
- G. Adjustable Shelves: Front, back, and ends formed down with returned lip at front and back.
- H. Toe Space: Provide metal toe space, fully enclosed, 4" (100 mm) high by 3" (75 mm) deep, with no open gaps or pockets.
- I. Table Legs: Not less than 2" (50-mm) square, electrically welded tubing. Provide leg stretchers where necessary to comply with structural performance requirements. Weld or bolt leg stretchers to legs and cross-stretchers. Securely bolt legs to table aprons. Provide leveling device welded to bottom of each leg.
- J. Leg Shoes: Vinyl or rubber, black, open-bottom type.
- K. Leg Shoes: Satin-finished stainless steel, slip-on type.

- L. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.
- M. Utility-Space Framing: Manufacturer's standard steel framing units consisting of 2 cold-rolled C-channel uprights, not less than 1-5/8" (41 mm) square by 0.10" (2.5 mm) thick, connected together at the top and bottom by U-shaped brackets made from 1-1/4" by 1/4" (32-by-6-mm) flat bars. Framing units may be made by welding C-channel material specified for uprights into rectangular frames instead of using U-shaped brackets.
- N. Base Molding: Extruded vinyl or rubber, black, 4" (100 mm) high. Provide on fronts and exposed ends and backs of floor-mounted casework.
- O. Filler Strips: Provide as needed to close space between cabinets and walls, ceilings, and indicated equipment. Fabricate from the same material and with the same finish as cabinets. Hem exposed edges.

2.04 FINISH FOR METAL LABORATORY CASEWORK

- A. Pretreatment: After assembly, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter by physical and chemical means. Treat entire unit with metallic phosphate process, leaving surfaces with uniform, fine-grained, crystalline phosphate coating to provide bond for finish.
- B. Chemical-Resistant Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, chemical-resistant, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and 2 mils (0.05 mm) for system.
- C. Chemical and Physical Resistance of Finish System: Provide metal laboratory casework with finish system complying with the following requirements for chemical and physical resistance:
 - 1. Chemical Resistance: Capable of withstanding application of not less than 5 drops (0.25 mL) of the following reagents applied to finish surface; covered with a watch glass for 60 minutes, rinsed, and dried; with no permanent change in gloss, color, film hardness, adhesion, or film protection.
 - a. Acetic acid (98%)
 - b. Hydrochloric acid (37%)
 - c. Nitric acid (25%)
 - d. Phosphoric acid (75%)
 - e. Sulfuric acid (85%)
 - f. Acetone
 - g. Benzene
 - h. Carbon tetrachloride
 - i. Ethyl acetate

- j. Ethyl alcohol
 - k. Ethyl ether
 - l. Formaldehyde (37%)
 - m. Furfural
 - n. Methyl ethyl ketone
 - o. Phenol (85%)
 - p. Toluene
 - q. Xylene
 - r. Ammonium hydroxide (28%)
 - s. Potassium hydroxide (40%)
 - t. Sodium carbonate (saturated)
 - u. Sodium chloride (saturated)
 - v. Sodium hydroxide (25%)
 - w. Sodium sulfide (saturated)
 - x. Zinc chloride (saturated)
2. Moisture Resistance: No visible effect when exposed to the following:
- a. Hot water at a temperature of 190° to 205°F (88° to 96°C) trickled down the surface at a 45° angle for 5 minutes.
 - b. Constant moisture using a 2-by-3-by-1-inch (51-by-76-by-25-mm) cellulose sponge, soaked with water, in contact with surface for 100 hours.
3. Cold Crack: No effect when subjected to 10 cycles of temperature change from 20°F (-7°C) for 60 minutes to 125°F (52°C) for 60 minutes.
4. Adhesion and Flexibility: No peeling or cracking or exposure of metal when metal is bent 180° over a 1/2" (13-mm) diameter mandrel.
- D. Colors: Comply with the following requirements for colors of metal laboratory casework finish:
- 1. Colors: As indicated by manufacturer's color designations.
 - 2. Colors: Match University's Representative's samples.
 - 3. Colors: Provide University's Representative's selections from manufacturer's full range of colors and finishes.

2.05 CASEWORK HARDWARE

- A. Hardware, General: Provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Stainless steel, 5-knuckle hinges complying with BHMA 156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors less than 48" (1200 mm) high and 3 for doors more than 48" (1200 mm) high.
- C. Pulls: Solid aluminum, stainless steel, or chrome-plated brass, fastened from back with 2 screws. For sliding doors, provide stainless steel or chrome-plated recessed flush pulls. Provide 2 pulls for drawers more than 24" (600 mm) wide. Pulls must meet ADA standards.
- D. Door Catches: Nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48" (1200 mm) high.
- E. Drawer Guides: Metal-channel, self-closing drawer guides, designed to prevent rebound when drawers are closed, with nylon-tired, ball-bearing rollers, and complying with BHMA A156.9, Type B05091.
- F. Label Holders: Stainless steel or chrome plated, sized to receive standard label cards approximately 1" X 2" (25 X 51 mm), attached with screws or rivets.
 - 1. Provide where indicated.
 - 2. Provide on all drawers.
- G. Drawer and Cupboard Locks: Half-mortise or cylindrical type, 5-pin tumbler and dead bolt or cam, only cylinder exposed, brass with chrome-plated finish, complying with BHMA A156.11, Grade 1.
 - 1. Provide minimum of 2 keys per lock and 6 master keys.
 - 2. Provide where indicated.
 - 3. Provide on all drawers and doors.
- H. Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door units.

2.06 TOPS, SINKS, AND TROUGHS

- A. Tops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Make exposed edges and corners uniformly beveled. Provide front and end overhang of 1" (25 mm) over base cabinets, formed with continuous drip groove on underside ½" (13 mm) from edge.
- B. Sinks, General: Provide sizes indicated or manufacturer's closest standard size of equal or greater volume, as approved by University's Representative.
 - 1. Outlets: 1-½" NPS (DN40) outlets with strainers and tailpieces a minimum of 6" (150 mm) long, of the same material as sink, or as otherwise approved by University's Representative.

2. Overflows: For each sink, except cup sinks, provide overflow of standard beehive or open-top design and with separate strainer. Height 2" (51 mm) less than sink depth. Provide in the same material as sink.
- C. Epoxy Tops, Sinks, and Troughs: Factory molded of modified epoxy-resin formulation, uniform mixture throughout full thickness with smooth, nonspecular finish.
1. Physical Properties: Comply with the following minimum requirements:
 - a. Flexural strength: 15,000 psi (100 MPa).
 - b. Compressive strength: 30,000 psi (200 MPa).
 - c. Hardness (Rockwell M): 100.
 - d. Water absorption (24 hours): 0.02% (maximum).
 - e. Heat distortion point: 350°F (177°C).
 - f. Thermal-shock resistance: Highly resistant.
 2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, test procedure 3.9.5:
 - a. Acetone: Moderate effect.
 - b. Acetic acid (98%): No effect.
 - c. Hydrochloric acid (37%): No effect.
 - d. Nitric acid (70%): No effect.
 - e. Phosphoric acid (85%): No effect.
 - f. Sulfuric acid (33%): No effect.
 - g. Benzene: No effect.
 - h. Butyl alcohol: No effect.
 - i. Carbon tetrachloride: No effect.
 - j. Ethyl acetate: No effect.
 - k. Ethyl ether: No effect.
 - l. Formaldehyde: No effect.
 - m. Phenol (85%): No effect.
 - n. Xylene: No effect.
 - o. Ammonium hydroxide (28%): No effect.
 - p. Sodium hydroxide (50%): Moderate effect.

- q. Zinc chloride: No effect.
- 3. Colors: Provide products that result in colors complying with the following requirements:
 - a. Color: Provide University's Representative's selection from manufacturer's full range of colors.
- 4. Top Fabrication: Fabricate with factory cutouts for sinks and with plain butt-type joints assembled with epoxy adhesive and prefitted, concealed metal splines.
 - a. Top Configuration: Square edge with drip groove and integral coved backsplash.
 - b. Top Thickness: 1-1/4" (32 mm).
- 5. Sink Fabrication: Molded in one piece with surfaces smooth, corners coved and bottom sloped to outlet; 1/2" (13-mm) minimum thickness.
 - a. Provide sinks with 1/4" (6-mm) thick lip around perimeter of sink for drop-in installation.
 - b. Bond epoxy sinks installed in epoxy tops to tops and finish to produce an integral unit with invisible joint line.
- D. Stainless-Steel Tops: Made from 0.0625" (1.6-mm) thick, stainless-steel sheet, ASTM A 666, Type 302 or Type 304 with No. 4 satin finish, and complying with the following requirements:
 - 1. Weld shop-made joints, and grind and polish surfaces to produce uniform, directional, textured, polished finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Where field-made joints are required, provide hairline butt-joints, mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum. Apply reinforcing channels to underside of top where necessary to insure rigidity without deflection.
 - 3. Extend top down to provide a 1" (25-mm) thickness and a 1/2" (13-mm) return flange under frame. Sound deaden entire undersurface with heavy-build mastic coating.
 - 4. Form backsplash coved to and integral with top surface.
 - 5. Provide raised marine edge around perimeter of tops containing sinks; pitch 2 ways to sink to provide drainage without channeling or grooving.
 - 6. Where stainless-steel sinks or cup sinks occur in stainless-steel tops, factory weld into one integral unit, grind welds smooth, polish, passivate, and rinse.
- E. Stainless-Steel Sinks: Made from 0.050" (1.27-mm) thick, stainless-steel sheet, ASTM A 666, Type 302 or Type 304. Fabricate with corners rounded and coved to at least 5/8" (16-mm) radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2" (13-mm) diameter. Provide continuous

butt-welded joints, grind smooth, and polish surfaces to produce finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1. Provide factory punchings for fittings.
 2. Apply approximately $\frac{1}{8}$ " (3-mm) thick, heat-resistant, sound-deadening coating to undersink surfaces.
- F. Cup Sinks: Epoxy, polypropylene, glass, or stainless steel, as indicated on Drawings.
- G. Troughs: Epoxy or stainless steel, as indicated. Comply with requirements for materials and construction as specified for tops or sinks. Pitch to drains not less than $\frac{1}{8}$ inch/foot (10 mm/m).

2.07 ACCESSORIES

- A. Reagent Racks: Single-or double-faced units as indicated, fabricated to suit type and composition of top.
- B. Wall Shelving: Provide wall shelving of materials indicated and as follows:
1. Plastic-Laminate Shelving: Plastic-laminate sheet complying with NEMA LD 3, Grade GP 28, shop bonded with fully waterproof glue to both sides and both edges of $\frac{3}{4}$ " (19-mm) thick particleboard. Sand surfaces to which plastic laminate is to be bonded.
 2. Phenolic-Composite Shelving: Factory-formed sheet complying with requirements for phenolic-composite countertops, thickness as follows:
 - a. Shelf Thickness: As indicated.
 3. Color, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed shelf surfaces complying with the following requirements:
 - a. Provide University's Representative's selections from manufacturer's full range of colors and finishes.
 4. Adjustable Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA 156.9, Types 04102 and B04112.
 5. Stainless-Steel Shelving: Shelves made from 0.050" (1.27-mm) thick, stainless-steel sheet, ASTM A 666, Type 302 or Type 304 with No. 4 satin finish. Fold down front edge $\frac{3}{4}$ " (19 mm) and hem; turn up back edge 3" (76 mm). Provide integral stiffening brackets, formed by folding up ends and welding to upturned back edge. Weld shop-made joints, grind smooth, and finish.
- C. Upright Rod Assembly and Metal Crossbar: Aluminum or stainless steel. Two vertical rods and 1 horizontal crossbar, $\frac{3}{4}$ " (19-mm) diameter and 36" (900 mm) long, unless otherwise indicated; 2 flush socket receptacles and 2 crossbar clamps. Taper ends of vertical rods to fit receptacles; all other rod ends are rounded.

- D. Burette Rods: Aluminum or stainless-steel rods, $\frac{1}{2}$ " (13-mm) diameter and 18" (450 mm) long, threaded on 1 end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.
- E. Greenlaw Arm Assembly: Aluminum or stainless-steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.
- F. Lattice Assembly: Aluminum or stainless-steel, vertical and horizontal rod lattice assembly with $\frac{3}{4}$ " (19-mm) diameter rods at approximately 12" (300 mm) o.c. with 2 flush socket receptacles for mounting.
 - 1. Size: as indicated.
- G. Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with polypropylene pegs and stainless-steel drip troughs.

2.08 WATER AND LABORATORY GAS SERVICE FITTINGS

- A. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.
- B. Material and Finish: Fabricate service fittings from cast or forged red brass, unless otherwise indicated.
 - 1. Finish exposed surfaces, including fittings, escutcheons, and trim, with a polished chrome-plating, unless otherwise indicated.
 - 2. Finish exposed surfaces, including fittings, escutcheons, and trim, with acid-and solvent-resistant, baked-on plastic coating in manufacturer's standard metallic brown, aluminum, or other color as approved by University's Representative.
 - 3. For reagent-grade water service fittings, provide polypropylene, PVC, or polyvinylidene fluoride for parts in contact with water.
- C. Water Valves and Faucets: Provide units complying with ASME A112.18.1M, with renewable seats, designed for working pressure up to 125 psig (860 kPa).
 - 1. Vacuum Breakers: Provide vacuum breakers on water fittings with serrated outlets.
 - 2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
 - 3. Self-Closing Valves: Provide self-closing valves where indicated.
- D. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (275 kPa). Provide with serrated outlets.
- E. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal. Provide with removable serrated outlets.

1. Provide high-pressure units for fine control designed for working pressure up to 150 psig (1035 kPa).
- F. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."
- G. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
- H. Handles: Provide 3-or 4-arm, forged-brass handles for valves, unless otherwise indicated.
1. For ground-key cocks, provide lever-type handles.
 2. For steam valves, provide heat-resistant plastic handles.
 3. For needle valves, provide knurled nylon handles.
- I. Service-Outlet Identification: Provide color-coded plastic discs, with embossed identification, secured to each service-fitting handle to be virtually tamperproof.

2.09 ELECTRICAL SERVICE FITTINGS

- A. Service Fittings, General: Provide UL-labeled units complying with Division 16 Sections, complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, and accessories and gaskets required for mounting on casework.
- B. Receptacles: Provide Hospital Grade, 2-pole, 3-wire grounding devices rated at 20A, 125VAC.
1. GFCI Receptacles: Provide ground-fault circuit interrupter duplex receptacles where indicated and when located in units containing water supplies or sinks.
 2. TVSS Receptacles: Provide duplex, hard-wired, transient voltage surge suppressor receptacles where indicated.
- C. Switches: Provide single-pole, double-pole, or 3-way switches, as required; rated 120 to 277VAC; and in amperage capacities to suit units served.
1. Provide pilot lights adjacent to toggle switch, where noted as "PL" next to switch identification.
 2. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.
- D. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or 2 faces, as indicated, with neoprene gasket under base and concealed mounting holes in base for attaching to casework. Provide holes tapped for conduits.
- E. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates the same size as boxes.
- F. Recessed-Type Fittings: Provide with galvanized steel boxes.

- G. Finishes for Service-Fitting Components: Furnish housings or boxes for pedestal-and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by University's Representative from manufacturer's full range of colors.
 - 1. Provide white-colored receptacles and switches as selected by University's Representative.
- H. Cover Plates: Provide satin finish, Type 302 or 304, stainless-steel cover plates with formed, beveled edges.
- I. Cover-Plate Identification: Provide identification on cover plates at receptacles, switches, terminal posts, and other locations as indicated. Provide $\frac{1}{4}$ " (6-mm) high letters, unless otherwise indicated. See also Division 16 for receptacle labeling requirements.
 - 1. Provide identification on the following devices whether indicated on Drawings or not:
 - a. Receptacles, other than standard 125V duplex, grounding type. Indicate voltage and phase.
 - b. Switches and thermal-overload switches. Indicate equipment being controlled.
 - c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious. Indicate equipment being controlled.
 - 2. On stainless steel, stamp or etch directly on plate and fill in letters with black enamel.

PART III - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcement, and other conditions affecting performance of metal laboratory casework installation.
 - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 CASEWORK INSTALLATION

- A. Install plumb, level, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- B. Utility-Space Framing: Secure to floor with 2 fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.
- C. Base Cabinets: Set cabinets straight, plumb, and level. Adjust subtops within $\frac{1}{16}$ " (1.5 mm) of a single plane. Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced 24" (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of $\frac{1}{16}$ " (1.5 mm).

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24" (600 mm) o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than 2 fasteners.
- D. Wall Cabinets: Hang cabinets straight, plumb, and level. Adjust fronts and bottoms within $\frac{1}{16}$ " (1.5 mm) of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24" (600 mm) o.c. Align similar adjoining doors to a tolerance of $\frac{1}{16}$ " (1.5 mm).
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises, unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- F. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.03 INSTALLATION OF TOPS

- A. Field Jointing: Where possible, make in the same manner as shop jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project site processing of top and edge surfaces is not required. Locate field joints where shown on approved Shop Drawings.
- B. Fastenings: Except for epoxy and phenolic-composite tops, use concealed clamping devices for field joints located within 6" (150 mm) of front, at back edges, and at intervals not exceeding 24" (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
 1. Secure tops, except for epoxy tops, to cabinets with Z-type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.
 2. Secure epoxy tops to cabinets with epoxy cement, applied at each corner and along perimeter edges of not more than 48" (1200 mm) o.c.
- C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in tops using clamping devices.
 1. Where necessary to penetrate tops with fasteners, countersink heads approximately $\frac{1}{8}$ " (3 mm) and plug hole flush with material equal to top in chemical resistance, hardness, and appearance.
- D. Provide required holes and cutouts for service fittings.
- E. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- F. Provide scribe moldings for closures at junctures of top, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

3.04 INSTALLATION OF SINKS

- A. Underside Installation: Use manufacturer's recommended adjustable support system for table-and cabinet-type installations.

- B. Set top edge of sink unit in sink and top manufacturers' recommended chemical-resistant sealing compound and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement.
- C. Semiflush Installation: Use stainless-steel sink frame, complete with clamping lugs and pads. Before setting, apply a full coat of sink and top manufacturers' recommended sealant under rim lip and along top. Omit sink frame if sink is fabricated with an integral rim seal.
- D. Drop-in Installation: Rout groove in top to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and top manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.05 INSTALLATION OF ACCESSORIES

- A. Install accessories according to approved Shop Drawings and manufacturer's written instructions.
- B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.
- C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

3.06 INSTALLATION OF SERVICE FITTINGS

- A. Comply with requirements of Division 15 and 16 Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring.
- B. Install fittings according to approved Shop Drawings and manufacturer's written instructions. Bed bases and flanges of sink and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings, piping, and conduit to casework, unless otherwise indicated.

3.07 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by University's Representative.
- C. Protection: Provide 6-mil (0.15-mm) plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at minimum of 48" (1200 mm) o.c.

END OF SECTION 12347



SECTION 150100 BASIC MECHANICAL REQUIREMENTS

PART I - GENERAL

1.01 RELATED SECTIONS

- A. 150500 – Basic Mechanical Materials and Methods
- B. 150600 – Pipes and Pipe Fittings
- C. 151000 – Valves and Piping Specialties
- D. 152400 – Vibration Isolators
- E. 152500 – Mechanical Insulation
- F. 158200 – Duct Accessories
- G. 158600 – Fans and Ventilators
- H. 158900 – Ductwork
- I. 159100 – Duct Accessories
- J. 159900 – Testing Adjusting and Balancing

1.02 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. National Electric Code – 2008 Edition with 2010 Edition of State of California Amendments
 - 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. AWWA 9th Edition
 - 10. SMACNA Guidelines and Specifications
 - 11. 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.

1.03 QUALITY ASSURANCE:

- 1. .
- 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.

1.04 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.

1.05 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.

1.06 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.

- C. Do disassembling and reassembling of equipment or other work necessary to accomplish this requirement without extra cost to the University.

1.07 MATERIAL LIST AND SUBSTITUTIONS:

- A. Comply with the requirements as stated in Specification Section 013300 and 016100. 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.

1.08 EQUIPMENT DATA AND OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit equipment data and operation and maintenance instructions in accordance with Specification Section 017800, 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. Piping Systems.
 - 3. Provide performance curves, charts and diagrams were applicable.
 - 4. 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 II - PRODUCTS

2.01 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.

2.02 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 III - EXECUTION

3.01 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 159900 – 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.

3.02 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.

3.03 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.

3.04 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.

3.05 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.

3.06 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.

3.07 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.

3.08 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.

3.09 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 017800 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 017800 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.
- B. 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.
- C. 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.
- D. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.
- E. Mark final positions of balancing valves after balancing is complete.
- F. All areas of building shall receive proper flow of hot water to assure adequate and uniform temperatures throughout.
- G. Final observation will not be made until all of the above have been completed and balance report has been submitted and reviewed.
- H. 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 Adobe 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 CLEAN UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, etc., and leave premises clean, neat, and orderly.

END OF SECTION 15010



SECTION 150500
BASIC MECHANICAL MATERIALS AND METHODS

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of mechanical related work specified in this section include the following:

1. Cathodic Protection
2. Roof and Wall Flashing
3. Pipe Identification
4. Thermometers
5. Gauges
6. Belt Drives and Guards
7. Electrical Motors and Motor Starters
8. Painting and Concrete Work

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data in accordance with requirements of Specification Section 013300.
- B. Equipment Data and Operation and Maintenance Instructions: Submit in accordance with Specification Sections 017800 and 150100 requirements.

PART II - PRODUCTS

2.01 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.

2.02 CATHODIC PROTECTION

- A. No dielectric unions allowed. Use 6" long red brass nipple with brass union for cathodic protection on all coil connections.

2.03 THERMOMETERS

2.04 GAUGES

2.05 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 $\frac{3}{8}$ " 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- $\frac{1}{2}$ 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.

2.06 ELECTRIC MOTORS

- A. Electric motors of more than $\frac{1}{2}$ HP rating shall be, unless otherwise noted, ball-bearing, open (drip- proof), squirrel cage, induction type, normal starting torque, 3-phase, 60-cycle service, 40°C 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 35°C. 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.

2.07 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.

2.08 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.

2.09 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 III - EXECUTION

3.01 CONCRETE WORK

- A. Where specifically indicated on the Drawings or specified as part of Mechanical Work, Contractor shall furnish and install concrete work, such as equipment bases and foundations in accordance with the requirements specified in Section 033000.
- B. Contractor shall coordinate requirements accordingly.

3.02 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.

3.03 INSTALLATION OF CATHODIC PROTECTION:

- A. Install 6" long brass nipple with brass unions in the following locations:
 - 1. In all metallic water and gas service connections into the building within 5' of the building wall. Install adjacent to the shut-off valve or cock and above ground where possible.
 - 2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
 - 3. At points in piping where dissimilar metal pipes are connected together.
 - 4. Any special applications shown on the Drawings.
 - 5. 6" long brass nipple and brass union shall be installed in place of dielectric unions on heating systems.
- B. Where steel or cast-iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast-iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.
- C. Where copper or brass piping is connected to steel or cast-iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape as specified in Section "Pipes And Pipe Fittings" extending outward a minimum of 5' on all pipes, from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thickness of the tape over the piping. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

3.04 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.

- K. 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
5/8" to 2" incl.	1/2"	2-1/2"
2-1/2" to 4" incl.	1"	4"
4-1/2" to 7" incl.	2"	5"
8" and larger	3"	6"

- L. 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.
- M. Markers shall be Brady "PIPE MARKERS" color code as per Pipe Markers self sticking Vinyl pipe markers.

Pipe Marking Schedule:

Legend

Hot Water - Heating Supply
Hot Water - Heating Return

Color

Yellow
Yellow

3.05 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.

3.06 FLASHINGS

- A. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped and sealed above flashing.

3.07 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





SECTION 150600 PIPES AND PIPE FITTINGS

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of piping systems and specialties specified in this section include the following:

1. Copper Tube
2. Miscellaneous Piping Materials/Products



1.02 QUALITY ASSURANCE

A. Welders' Qualifications:



1. Copper Brazing:
 - a. Certified yearly by P.I.P.E., or agency that meets AWS B2.2-85 Brazing Procedure, American Welding Society Standards.
 - b. Show current brazing certifications upon request.
 - c. Certification shall be copied and provided to University's Representative to be kept on file by University's Plant Operations and Maintenance Plumbing Supervisor for duration of the job.

B. Manufacturers: Firms regularly engaged in manufacture of supports and anchors of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

C. Requirements of Regulatory Agencies:

1. Comply with applicable codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are Underwriters Laboratories listed and Factory Mutual approved.

1.03 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned Drawings for each type of support, anchor, and seal listed in this Section.

B. Welding and Brazing Certifications: Submit reports as required for piping Work.



PART II - PRODUCTS

2.01 GENERAL

- A. Provide pipe and tube, joint type, grade, size, and weight indicated for each service, and comply with governing regulations and industry standards.

2.02 COPPER TUBE AND FITTINGS



- A. No type "M" copper pipe to be used on building systems, "L" or "K" only. Use only type "K" below ground, all joints below ground to be brazed.
 - 1. Supply water piping to fixtures and equipment shall be a minimum of 1/2" or sized per code, unless indicated otherwise on the drawings.
- B. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

2.03 HANGERS AND SUPPORTS



- A. Vertical Piping:
 - 1. Support vertical piping risers securely with riser clamps, Tolco Fig. 6, or equal. Attach clamps to the pipe above each concrete floor slab, with the arms of the clamp resting on the slab or the structural supports.
 - 2. Support pipelines passing up through the building at each floor of the building.
- B. Horizontal Piping:
 - 1. Pipe hangers shall be Tolco, Grinnell, Super Strut, or equal.
 - 2. Use Tolco Fig. 3, or equal, steel strap hanger for uninsulated steel or cast-iron pipe through 8" size, and for insulated steel or cast-iron pipe through 4" size. Use Tolco Fig. 1, or equal, steel hanger in pipe sizes where suitable. Use saddle shield as specified for insulated pipes.
 - 3. Use cushioning clamps when using unistrut.
- C. Pipe Saddles:
 - 1. Insulation shall be protected by USS No. 18 gauge galvanized steel shield, with a minimum length of 8".
 - 2. Pipe saddles shall be Insul-Shield by Tolco multipurposed pipe saddles manufactured by Insul-Coustic Corporation, Thermal Hanger Shields by Pipe Shields, Inc., or equal.
 - 3. Concrete Inserts: Provide Hilti, Tolco, or equal.

PART III - EXECUTION

3.01 INSTALLATION OF PIPING:

- A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves

and equipment. Reduce sizes where indicated by use of reducing fittings. At locations where a reduced fitting is required, contractor shall use factory reducing fittings or bell reducers, do not use bushings. Align piping accurately at connections, within $\frac{1}{16}$ " misalignment tolerance.

- B. Comply with ANSI B31 Code for Pressure Piping.
- C. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations, or if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to $\frac{1}{2}$ " where furring is shown for enclosure or concealment of piping; locate insulated piping for one-inch clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures. Install drip pan under piping that must be run through electrical spaces and in all other locations indicated on Drawings.
- E. Should structural difficulties or Work of other Contractors prevent the running of pipes or the setting of equipment at the points shown, the necessary deviations there from, as determined by the Contractor, with the University's review, will be allowed but shall be made without additional cost to University.
- F. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.
- G. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.
- H. Cap or plug openings in pipe and fittings immediately to exclude all dirt until fixtures are installed or final connections made.
- I. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.
- J. Couplings shall not be used except where required pipe runs between fittings are longer than a standard length of the type of pipe being used and except where their use is specifically reviewed by the University's Representative.
- K. Conceal piping in finished portions of building, above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.
- L. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.
- M. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.
- N. Install low point drains on all piping at the lowest point in the system to enable the total drain down of the system for the purpose of repairs, retrofits or remodels. Lines from 4"



through 10" pipe shall have a 2" low point drain and 2" SOV. Lines 2" through 3-½" shall be a 1-½" low point drains and 1-½" SOV. Smaller size lines use line size low point drains and SOV's. Include plugs in end of shutoff valves. Drain valves shall be 800 lb. Full port gate valve on 240° heating hot water systems.



- O. Manual Air Vent: At all high points and all coils, furnish a manual air vent with SOV. Assembly shall consist of a ½" IPS ball valve and ½" gooseneck pipe of same material as piping.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. General:

1. Fasten all piping securely to building construction with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers and/or add as necessary to correct unsatisfactory conditions that may become evident when system is put into operation. All piping shall be independently supported from the building structure. No piping shall be used to support other piping.
2. Follow drawing requirements and details where special pipe support requirements are detailed on the Drawings.
3. Do not support piping by perforated tape, wire, rope, wood, nails, or other makeshift devices.
4. Design hangers and supports to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used.
5. Burning or welding on any structural member under load shall not be attempted. Field welding not called for on the Drawings or reviewed shop Drawings may only be done with consent and advice of the University and after proper provisions have been made to relieve the stress on the member. The boring of holes in beam flanges or narrow members will not be allowed.
6. Install hanger on insulated piping in a manner which will not produce damage to insulation. Provide steel pipe saddles as required to protect pipe covering. Install pipe hangers on piping covered with insulation on the outside of the insulation and not in contact with the pipe.
7. Fasten hanger rods to concrete structural members with concrete inserts set flush with surface. Install a reinforcing rod through the opening provided in the concrete

inserts. Fasten hanger rods to structural members with suitable beam clamps, and provide beam clips to lock clamp securely to beam.

8. Use of powder-actuated fasteners will not be permitted for the support of any overhead piping.
9. Turnbuckles, if used, shall have a load-carrying capacity at least equal to that of the pipe hanger with which they are being used.
10. All threaded parts of pipe hanger assemblies shall have full length of thread in service while in use.
11. All hangers, hanger supports, hanger trapeze supports, fire piping hangers and strut supports shall have one nut on top and double nutted below.

B. Pipe Hanger or Support Spacing:

1. Provide pipe hangers or supports at 6' maximum spacing on steel pipe 1" diameter and smaller and for copper pipe 1-½" and smaller Tolco.
2. Support steel piping larger than 1" and copper larger than 1-½" at 10' maximum spacing.
3. Provide hangers or supports for horizontal cast-iron soil pipe at every other joint, except that when the developed length between hangers exceeds 4', provide hangers at each joint. Spacing of hangers shall not exceed 5'. Provide adequate sway bracing to prevent shear. Horizontal cast iron piping (waste and vent) shall have hangers installed on each side of piping and fitting joints. Hangers shall be within 18" of the joints. On horizontal and vertical piping and fittings, use felt pad vibration isolators, Superstrut 715 and 716, Semco Trisolators, or equal. Do not use felt pad isolators without metal or plastic shield.

3.03 PIPING SYSTEM JOINTS:



- A. General: Provide joints of type indicated in each piping system.
- B. Cut all hard copper tubing by power hacksaw, a circular cutting machine using an abrasive wheel or in square end vise by means of hand hacksaw. Pipe shall have round edges or burrs removed so that a smooth and unobstructed flow will be obtained.
- C. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.
- D. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- E. Solder copper tube and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Solder shall be 95% tin, 5% antimony and shall be used above grade only. Wipe excess solder from joint before it hardens.
- F. Branch tees in copper tubing, provided that branch size is one-half the size of the main or smaller, may be made with Bonney Brazolets, or equal, with socket, or threaded outlets as required, and with factory-furnished curvature and socket dimensions for the specific type of copper tubing on which it is to be used. Make up joint between the "Brazolet" and the

main with silver brazing alloy, as specified. No tapping of schedule 40 or schedule 80 pipe for air vents, petes plugs, etc. Install fittings or weld on ¼" steel couplings or thread-o-lets.



1. No tee to be pulled. No stub-ins. No pipe saddles.

G. Install forged branch-connection fittings wherever branch pipe of two pipe sizes smaller than main pipe is indicated; or install regular "T" fitting.

3.04 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule and show no loss in pressure or visible leaks after a minimum duration of four hours at the test pressures indicated.



TEST SCHEDULE SYSTEM TESTED	TEST PRESSURE PSIG	TEST WITH
Hot and chilled water distribution system connections.	225 lbs.	Water
Hot and cold water piping (heating & plumbing)	150 lbs. rough-in. 150 lbs. after equipment connection.	Water

B. Testing equipment, materials, and labor shall be furnished by Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.05 CLEANING OF HYDRONIC PIPING SYSTEMS AND EQUIPMENT

A. Heating systems shall be cleaned and flushed as follows:



Soda Ash	41%
Sodium Silicate Pontahydrate	34%
Sodium Tri-Polyphosphate	24%
Wetting Agent, Non-Toxic	1%
Non-Foaming	

Water containing this detergent shall be circulated for not less than six (6) hours. When completed, flush entire system and clean all strainers. Refill with low mineral content water.

B. Under current interpretation, an Agricultural Pest Control Business License is required to perform water chlorination/disinfection for hire on potable water lines. The most appropriate pest control category possessed by the qualified applicator licensee to supervise the pest control operations of that type of business is Category A - Residential, Industrial and Institutional Pest Control. This license requirement includes all underground piping and all piping in buildings, new, remodel and retrofit systems.

3.06 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 15060



**SECTION 151000
VALVES AND PIPING SPECIALTIES**

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of piping specialties specified in this section include the following:

1. Fully ported IPS or Flange bodies only; no solder joint valves.
2. Pipe Escutcheons
3. Pipeline Strainers
4. Sleeves
5. Sleeve Seals
6. Unions and Flanges

B. Types of valves specified in this section include the following:

1. All valves shall be I.P.S. only, no solder joint valves.

C. Balance Valves Drain Valves
Butterfly Valves Check Valves

Ball Valves

1. All shutoff valves in ground on UCD Medical Center property shall open by turning to the left or counter clockwise, city valves open by turning to the right or clockwise.

1.02 QUALITY ASSURANCE

A. Manufacturers Qualifications: Firms regularly engaged in manufacturing of plumbing piping systems products, of types, materials and sizes required. Whose products have been in satisfactory use in similar service for not less than five (5) years. On changes, submittals,

etc., Contractor shall supply needed documents to support the manufactures' qualifications.

- B. Valve Types: Provide valves of same type by same manufacturer.
- C. Identification: Provide piping specialties and valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- D. Requirements of Regulatory Agencies:
 - 1. UL and FM Compliance: Provide valves used in fire protection piping which are UL listed and FM approved.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of manufactured piping specialty and valve.
 - 1. Include pressure drop curve or chart for each type and size of valve, control valve and balancing valve.
- B. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty and valve. Include this data and product data in maintenance manual in accordance with requirements of Division 1.

PART II - PRODUCTS

2.01 MATERIALS

- A. Provide factory-fabricated piping specialties and valves recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Contractor to comply with installation requirements. Provide sizes and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Contractor's option.
- B. Unless otherwise indicated, provide valves of same size as upstream pipe size.

2.02 PIPE ESCUTCHEONS

- A. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings,

or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

- B. Manufacturers: Chicago Specialty Manufacturing Company, Producers Specialty and Manufacturing Corporation, Sanitary-Dash Manufacturing Company, or equal.

2.03 PIPE SLEEVES

- A. Where pipes pass through concrete floors or walls, install galvanized metal or plastic sleeves having not less than 1/2" or more than 1" clearance around sides of the pipe or pipe covering for the full thickness of the concrete.

1. After piping has been installed, fill annular space with fireproof safin.

- B. Manufacturers: Adjustocrete, Sperzel "Crete-Sleeve", or equal.

2.04 SLEEVE SEALS

- A. Provide sleeve seals for sleeves located in foundation walls below grade or in exterior walls as follows:

1. Walls and Floors: Modular-mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

- B. Manufacturers: Link-Seal Corporation - Thunderline Corporation, or equal.

2.05 UNIONS AND FLANGES

- A. Furnish and install unions at each threaded connection to all equipment, tanks and valves, of type specified in following schedule:

<u>Type of Pipe</u>	<u>Union</u>
Copper tubing, 1-1/4" and smaller	250 lb. bronze ground joint, bronze to bronze sweat connection.
Copper tubing, 1-1/2" and larger	250 lb. cast bronze, flat faced flange with silver brazing threadless ends.

- B. Insulating couplings or flanges shall be furnished and installed at all connections of piping with dissimilar materials. Construct couplings so that the two pipes being connected are

completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic threaded coupling in standard pipe sizes.

C.

<u>Type of Pipe</u>	<u>Flanges</u>

D. Provide full faced or ring type gasket material to suit facing on flanges per following schedule:

<u>Service</u>	<u>Type</u>
Hot Water	1/16" thick Flexataulic gasket, or equal, no known equal.

2.06 EXPANSION JOINTS

- A. Combination Couplings and Nipples: Provide expansion joints constructed of cut, grooved, short pipe nipples and couplings, designed by manufacturer to suit intended service. Provide removable ties to hold joint compressed or expanded during piping fabrication, depending on application. Select standard weight couplings and gasket materials to match balance of piping system. Provide at least three couplings at each expansion joint indicated on Drawings as recommended by manufacturer.
- B. Manufacturers: ITT Grinnell, Stockham Valves and Fittings, Inc., Vitaulic Company of America, or equal.

2.07 FLEXIBLE CONNECTIONS

- A. Use stainless steel double braided flexible connections for all flexible connections. Metraflex, or equal.

2.08 HIGH AND LOW-PRESSURE, Y-TYPE PIPELINE STRAINERS

- A. Provide strainers full-line size of connecting piping, with ends matching piping system materials and cast-iron body. Select strainers for 250 psi (high pressure) and 125 psi (low pressure) working pressure, with monel screens and gasket seal on plug. Provide ball valve - no globe or needle valves. Smallest valve to be 1/2" full port IPS. All with 3/4" hose connector.
- B. Strainer screens shall have an open area equal to at least twice the cross-sectional area of the pipe in which they are installed (based on IPS) and may be either woven wire or perforated type in accordance with the following:
 - 1. All Services: .045-inch diameter perf. or 16 square mesh.
- C. Manufacturers: Armstrong Machine Works, Bailey Meters, Hoffman Specialty ITT; Fluid Handling Division, Watts Regulator Company, or equal.

2.09 VALVES

- A. Provide valves as shown and other valves necessary to segregate branches or units. Furnish discs suitable for service intended. Furnish a brass tag with unique identification

of service controlled for each valve. Properly pack and lubricate valves. No solder valves allowed. Provide flanged valves in welded pipe.

1. All fixtures and equipment branch lines to have shut-off valves at branch connection.
 2. All Shut-off Valves will be IPS "or 3 piece body" valves. Three-piece valves may be soldered.
 3. All angle stops will be IPS at wall, loose key. Threaded brass nipple shall be installed upstream of angle stop.
 4. Shut off valves on heating and chilled water to be ball valves thru 2" and butterfly 2-½" and up. All valves are to be brazed, threaded or flanged. No solder.
 5. Valves installed in insulated piping lines shall have valve handle extensions to clear the insulation. On insulation, affix label for valve location with directional arrow.
 6. Shut-off valves shall be provided locally, upstream and downstream of all insulating fittings (unions, nipples, flanges, etc.) so that repairs can be made easily on these fittings.
 7. All building shut-off valves from Central Plant distribution system shall be Class 150 stainless steel flanged ball valves, Nibco or equal.
 8. Manufacturers: Nibco or equal.
- B. Valves shall be full size of pipe in accordance with the following schedule: shut-off valves size ¾" to 2" shall be ball valves; size 2-½ and larger shall be butterfly.
- C. Balancing Valves shall provide multi-turn, 360° adjustment with a micrometer type indicator located on valve hand wheel. Valve handwheel shall have hidden memory feature which will provide a means for locking the valve in position after the system has been balanced.
1. Manufacturers: Armstrong, Victaulic, or equal.
 2. Plug design valves are not acceptable.
 3. 90 Degree turn adjustable valves are not acceptable.
- D. Butterfly Valves: Nibco, Norriseal or equal, equal to Demco Series NE. Provide lug body on valves located adjacent to equipment. All valves shall have EPT seats with aluminum bronze disc and throttling handle with memory stop. Furnish flow performance curve for each valve. Provide gear operators, handles for shut-off service, and infinite position

throttling handles with indicator plates for balancing service. No wafer valves. All valves on heating water system shall be water 250°F or higher.

- E. Manual Air Vent Valves: At all high points and all coils, furnish a manual air vent with SOV. Assembly shall consist of a ½" IPS ball valve and ½" gooseneck pipe of same material as piping.
- F. Shut off valves located in ceilings, walls, and floors shall be accessible through access doors or ceiling lift out tiles (finished ceiling). Valve handles shall be located within 24" of access door.
- G. Check valves shall be ball check Conbraco or equal.

PART III - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.
- B. Sleeves: Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand. After forms have been removed from concrete, the sleeves shall be removed from the openings.
- C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.
- D. Sleeve Seals: Install in accordance with the following:
 - 1. Lead and Oakum: Replace existing lead and oakum seals with link seal or equal.
 - 2. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve opening and center. Tighten bolts until links have expanded to form watertight seal.
- E. 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 tab 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 University's Representative.

3.02 INSTALLATION OF Y-TYPE STRAINERS

- A. Install Y-type strainers full size of pipeline in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding

individual terminals. No smaller than $\frac{1}{2}$ " - use ball. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow-down connection.

- B. All strainers shall have ball valve blow down valves not less $\frac{1}{2}$ " in size with $\frac{3}{4}$ " hose connector with cap and washer.
- C. Locate Y-type strainers in supply line ahead of the following equipment and elsewhere as indicated if integral strainer is not included in equipment:
 - 1. Backflow Assemblies
 - 2. Pumps
 - 3. Temperature control valves
 - 4. Pressure-reducing valves
 - 5. All coils Delta "P" valves

3.03 INSTALLATION OF VALVES

- A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. All branches from vertical risers to have SOV's.
- B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane. Do not install check valves designed for horizontal use in the vertical position.

- C. Provide threaded union at each connection to equipment and downstream of each valve. Provide unions at both ends of valves when valves cannot be turned due to an obstruction. Contractor shall furnish to University extended tee style valve handles for in-ground valves and special application valves with removable handles.
- D. After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
- E. Tag each valve and provide a complete listing of valve locations and functions.

3.04 INSTALLATION OF UNIONS AND FLANGES:

- A. Install threaded unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Provide a minimum of three unions at each three-way valve.

END OF SECTION 151000





SECTION 151750
VARIABLE FREQUENCY DRIVES (VFDs)

PART I - GENERAL

1.1 WORK INCLUDED

- A. Extent of variable frequency drives work is indicated by drawings and schedules and by requirements of this section.
- B. Variable frequency drives shall be provided as shown.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. Standard 519-1992, IEEE Guide for Harmonic Content and Control
 - 2. Underwriters Laboratories
 - a. UL508C
 - 3. National Electrical Manufacturer's Association (NEMA)
 - a. ICS 7.0, AC Adjustable Speed Drives
 - 4. IEC 16800 Parts 1 and 2

1.3 SUBMITTALS

- A. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalog information.
- B. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - 1. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, no exceptions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handle variable frequency drives carefully to avoid damage to components, enclosures and finish. Do not install damaged components; replace and return damaged components to variable frequency drives manufacturer.

- B. UL Compliance: Provide variable frequency drives that have been listed and labeled by Underwriters Laboratories or by a testing organization of equal standing.
- C. UL Compliance: Provide electric components for air handling units which have been listed and labeled by Underwriters Laboratories or by a testing organization of equal standing.

PART II - MATERIALS

1.1 VARIABLE FREQUENCY DRIVES

- A. VFDs shall be solid state, with a Pulse Width Modulated (PWM) output waveform utilizing insulated gate bipolar transistors (IGBTs.) The VFD package specified herein shall be completely assembled inside a minimum rated NEMA 12 enclosure and tested by the manufacturer. For outdoor installations, provide a minimum rated NEMA 3R weatherproof enclosures with thermostatically controlled, filtered forced air ventilation selected at 110°F ambient temperature. Both inlet and outlet louvers to be filtered. The drive efficiency shall be 97% and fundamental power factor shall be 0.98 at all speeds and loads.
- B. Manufacturer: The VFD shall be ASEA BROWN BOVERI (ABB) Model ACH 580 or equal. All items in the specification must be strictly adhered to. Any deviations must be submitted and approved in writing ten working days prior to the bid date.
- C. VFDs shall have the following standard features:
 - 1. VFDs shall utilize a plain language digital display (code numbers are not acceptable). The digital display shall be a 40 character minimum LCD display. All set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes.
 - 2. VFDs shall have a Hand-Off-Auto switch and speed potentiometer.
 - 3. VFDs shall have input line fuses standard inside the drive enclosure.
 - 4. VFDs shall have an input line reactor to mitigate harmonic distortion and AC voltage transients. Manufacturer shall include in the submittals harmonic distortion analysis (IEEE Standard 519, 5% voltage) for this particular jobsite including total voltage distortion. Equipment exceeding 5% total harmonic voltage distortion shall not be accepted.
 - 5. VFDs shall be provided with displays or meters showing:
 - a. Output frequency
 - b. Motor speed (RPM)
 - c. Motor current
 - d. Motor power
 - e. DC bus voltage
 - f. Output voltage

- g. Heat sink temperature
 - h. Analog input values
 - i. PI setpoint values
 - j. Elapsed time meter
 - k. KW-hour meter
 - l. Last three faults
- 6. VFDs shall use the same digital display, keypad and customer connections regardless of horsepower ratings. All drive settings shall be through programmable inputs on the drive keypad.
 - 7. VFDs shall have an electronic parameter lock to prevent unauthorized personnel access to programming the VFD. Manufacturers not having this feature shall provide the VFD in an additional enclosure that shall include forced and filtered ventilation, a key-lock and a viewing window for display.
 - 8. VFDs shall operate with an input voltage range from 400 - 550 VAC and 187 - 264 VAC without trip. Manufacturers not meeting this shall provide and install a constant voltage transformer with harmonic suppression circuits and an electrostatic shield for each VFD.
 - 9. The VFD shall start into a rotating load (forward or reverse) without a trip.
 - 10. The VFD shall have an adjustable carrier frequency 1 to 12 kHz minimum to reduce motor acoustical noise. Manufacturers not meeting these requirements shall provide acoustical noise reduction filters on the drive output.
 - 11. The drive shall employ three current limit circuits to provide trip free operation (slow current regulation, rapid current regulation, and current limit switch-off limit.) Manufacturers shall size drives so that the overcurrent trip shall be 315% minimum of the drives current rating.
 - 12. Provide a control transformer and all other provisions necessary for the required control loads.
 - 13. Provide an VFD enclosure disconnect switch.
- D. VFDs shall have the following field programmable features:
- 1. Five (5) programmable critical lockout ranges.
 - 2. PI setpoint controller shall be standard in the drive, allowing a pressure, flow, or temperature signal to be connected to the VFD, using the microprocessor and isolated power supply in the VFD for closed loop control. Manufacturers not having this feature shall provide and install a PLC PI controller (with digital display of setpoint and sensor value in programmable units, e.g., inches w.c.) integral to the drive package.

3. Control inputs and outputs:
 - a. Isolated from ground & line voltage
 - b. Six digital inputs
 - c. Seven preset speeds
 - d. Three digital outputs
 - e. Two analog outputs
 - f. Floating point control
 - g. Fully field programmable
 4. Digital outputs shall include field adjustable motor current levels for motor status. Drives not having this feature shall provide and install field adjustable three phase current relays for digital status of motor.
 5. Analog outputs shall include (but not limited to) KW, speed, and voltage. Manufacturer not having KW output shall provide current transformers and KW transducers for KW output.
 6. The VFD shall have RS-485 port for serial communications as standard and shall incorporate embedded field buses in memory providing direct serial communication to Johnson Controls Metasys N2 Bus. No additional integrators will be required. N2 Bus Protocol shall provide at least 11 points (7 AI, 4 DI) of VFD control and 18 points (12 AO, 6 DO) of monitoring VFD status.
- E. Accessories to be furnished and mounted by the VFD manufacturer:
1. Customer interlocked terminal strip for connection of fire and smoke control contacts, and external start commands. All external interlocks shall function in hand, auto, or bypass.
 2. Manual transfer to line power bypass switch shall be via three contactors with door interlock circuit breaker and service switch where indicated. Include motor thermal overload and fuse or circuit breaker protection while in bypass operation. Two 3-position selector switches to control the bypass contactor and the drive input contactor shall be mounted on the enclosure door. Door mounted status lights shall include: power on, drive, bypass, and safety. Pad-lockable door interlock disconnect shall be provided.
 3. Entire assembly shall be UL listed.

1.2 START-UP/WARRANTY/TRAINING

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

- B. Start-up shall include customer operator training at the time of the equipment commissioning providing a minimum of three one-hour training sessions covering VFD design, operation and maintenance.

PART III - EXECUTION

1.1 START-UP SERVICE

- A. The manufacturer shall provide certified start-up commissioning of the variable frequency drives and its optional circuits by a factory certified service technician who is experienced in the start-up and repair services.
- B. A certified start-up form shall be filled out for each drive with a copy provided to the Owner and a copy kept on file with the manufacturer. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system and equipment serviced.

1.2 EXAMINATION

- A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust and moisture of the environment. Installation shall be per the manufacturer's recommendations.
- B. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

1.3 WARRANTY

- A. Warranty shall be no less than 18 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION 151750





SECTION 152500 MECHANICAL INSULATION

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of insulation specified in this section include the following:

1. Piping System Insulation:
 - a. Domestic Cold Water
 - b. Domestic Hot water
 - c. Heating Hot Water
2. Ductwork System Insulation:
 - a. Supply Ducts
 - b. Return Ducts
3. Equipment Insulation:
 - a. Heating Equipment

1.02 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products of type, material and sizes specified. Products have been in satisfactory use in similar service for not less than three (3) years. Contractor shall supply needed documentation to support the manufacturer's qualification.
- B. Installer's Qualifications: Firm with at least five (5) years successful installation experience on projects with mechanical insulation's similar to that required for this project.
- C. Install thermal insulation products on equipment in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with flame-spread rating of 25 or less and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- E. Building insulation shall comply with California Quality Standards for insulating material.
- F. Insulation material shall be certified by the California Energy Commission.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data in accordance with requirements of Specification Section 013300. Submit manufacturer's technical product

data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, density, and furnished accessories for each mechanical system requiring insulation. Include complete description of installation methods with this submittal.

- B. Product Data and Maintenance Instructions: Submit in accordance with Specification Sections 017800 and 150100 requirements.

PART II - PRODUCTS

2.01 PIPE INSULATION MATERIALS:

A. Fiberglass Insulation:

1. Fiberglass Heavy Density 25, Johns-Manville Microlok, with ASJ-SSL jacket, or equal, with factory-applied, fire- retardant jacket and self-sealing laps, applied per manufacturer's recommendations.
2. Insulate fittings with JM Uni-Fit, or equal, pre-molded insulated covering secured with Standard fasteners.
3. Install a segment of rigid insulation at each pipe hanger for pipe sizes 2-1/2" and larger.
4. Finish all cold fittings with mastic and Z-tape to provide a vapor seal.
5. Insulate Victaulic couplings with a 12" long segment of Fiberglass as specified for concealed piping.
6. Manufacturers: Johns-Manville Corporation, Owens-Corning Fiberglass Corporation, or equal.

2.02 DOMESTIC COLD WATER (exterior exposed to weather):

A. Insulate with 4 lb. nominal density fiberglass insulation.

B. Minimum Insulation Thickness:

1. Piping 2" and smaller: 3/4".
2. Piping 2-1/2" and larger: 1".

C. Fittings

1. Insulate all unions, couplings, and other components in water systems with removable (replaceable) formed insulated covers.

D. Insulation Jacket

1. Cover all insulation on exterior piping with 20-mil thick fire-retardant PVC jacket. Apply jacket to insulated surfaces and seal with PVC solvent-type joints. Provide pre-molded insulation covering on fittings. Piping shall be sealed vapor tight to provide a continuous moisture-proof seal.

2.03 DOMESTIC HOT WATER

- A. Insulate all domestic hot water supply and return piping with 4 lb. nominal density fiberglass insulation.
- B. Minimum Insulation Thickness:
 - 1. Piping 2" and smaller: 1".
 - 2. Piping 2-1/2" and larger: 1-1/2".
- C. Valves and Fittings
 - 1. Insulate all valves, unions, Victaulic couplings, and other components in hot water systems with removable (replaceable) formed insulated covers.
 - 2. Valves installed in insulated piping lines shall have valve handle extensions to clear the insulation. Affix label for valve location and directional flow.
- D. Insulate domestic hot water piping and waste piping below handicapped plumbing fixtures. On all handicap fixtures that require user protection from the hot water supply and the P-trap, said items shall be covered with Skat + Gard protective devices, Truebro-lav Guard. All materials used shall be fire retardant. Do not use adhesive wrapping on P-trap or angle stops/water supply risers.

2.04 HEATING HOT WATER

- A. Insulate all heating hot water supply and return piping with 4 lb. nominal density fiberglass insulation.
- B. Minimum Insulation Thickness:
 - 1. Piping 2" and smaller: 1-1/2".
 - 2. Piping 2-1/2" and larger: 2".
- C. Valves and Fittings
 - 1. Insulate all valves, unions, Victaulic couplings, and other components in heating hot water systems with removable (replaceable) formed insulated covers.
 - 2. Valves installed in insulated piping lines shall have valve handle extensions to clear the insulation. Affix label for valve location and directional flow.
- D. Insulation Jacket
 - 1. Cover all insulation that may be exposed to water, i.e. exterior piping, mechanical room, etc. with aluminum jacket. Apply jacket to insulated surfaces per manufacturer's recommendation. Provide pre-molded insulation covering on fittings.

2.05 DUCTWORK

- A. All ductwork insulation to be exterior only. Wrap all supply and return ductwork and sound traps, unless indicated or specified otherwise, with 1-1/2" thick, 1-pound density Fiberglas

100P, Johns-Manville, or equal, no known equal, fiberglass duct insulation lapped four inches and held in place by 16-gauge galvanized wire tied on 12" centers.

- B. Apply adhesive to entirely cover the circumference of ducts to prevent sagging of insulation before wrapping insulation around ducts.
- C. For rectangular ducts exceeding 24" in width, provide mechanical fasteners on bottom of duct at maximum spacing of 18" c.c. Fasteners shall be weld pins or clinch pins: adhesive type pins shall not be used.
- D. Cover all ductwork that may be exposed to water, including the mechanical room, with fiberglass, and protect with a sealant adhesive, Foster SEALFAS, Hardcast Flex-Grip, Childers Chil-Perm or equal. All products used must have a flame spread rating of less than 25 or be rated as a composite system with a flame spread rating of less than 50.
- E. Cover all standing seams and transverse joints in all ductwork with a sealant adhesive before insulating to assure airtight joints.
- F. Pressure-sensitive tapes shall not be used.
- G. Manufacturers: Certain Teed Corporation, Johns-Manville Corporation, Owens-Corning Fiberglas Corporation, or equal.

2.06

PART III - EXECUTION

3.01 INSTALLATION OF PIPING INSULATION:

- A. Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single-cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. The term "piping" used herein shall include pipe, valves, strainers, and fittings. Apply insulating cements to fittings, valves, and strainers, and trowel smooth to the thickness of adjacent covering. Covering on valves shall extend up to the bonnet. The covering cement shall be of the types herein specified.
- F. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.
- G. Install pipe hangers on the outside of the insulation and not in contact with the pipe. Protect insulation as hereinbefore specified under Hangers and Supports.
- H. Neatly taper raw ends of insulation and seal with canvas and sealant as noted for fittings.

3.02 INSTALLATION OF DUCTWORK INSULATION

- A. Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except piping through fire walls and where otherwise indicated.
- C. Exposed high-velocity ductwork shall be wrapped. Insulation shall be same as for concealed ducts but applied using butt joints with adhesive over entire surface of duct. Apply 6-ounce canvas jacket and two finish coats of undiluted adhesive to exterior. Covering shall be even and level without lumps.

END OF SECTION 152500



**SECTION 153000
FIRE PROTECTION****PART I - GENERAL****1.01 WORK INCLUDED**

- A. Furnish all labor, materials, tools, and equipment to complete the automatic fire sprinkler system as hereinafter described, ready for service to the entire satisfaction of the University's Representative and University Fire Department. Provide hydraulically calculated systems for light and ordinary hazard occupancy as noted in NFPA 13, 1999 edition or latest adopted code by authority having jurisdiction. Provide calculations based on 10% minimum safety factor.
- B. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.
- C. It is the intent of these Specifications and Drawings to provide for a complete and operating automatic fire protection sprinkler system in full compliance with the standards of the National Fire Protection Association as set forth in NFPA Pamphlet No. 13, 1999 edition or

latest code adopted by authority having jurisdiction. The work must also be in accordance with all local or state requirements which apply.

1.02 JOB CONDITIONS

- A. Coordinate Work of this Section with that of other Sections to ensure that Work shall be carried out in an orderly fashion.
- B. Coordinate all equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.03 QUALITY ASSURANCE

- A. Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Requirements of Regulatory Agencies:
 - 1. NFPA Compliance: Install fire protection systems in accordance with the following standards:
 - a. NFPA 13 "Standard for the Installation of Sprinkler Systems" 1999 edition or latest adopted code by authority having jurisdiction.
 - b. NFPA 14 "Standard for the Installation of Standpipe and Hose Systems" 2000 edition or latest adopted code by authority having jurisdiction.
 - c. NFPA 20, Standard for the Installation of Fire Pumps, 1999 edition or latest adopted code by authority having jurisdiction.
 - 2. UL Compliance: Provide fire protection products in accordance with UL standards; provide UL label on each product.
 - 3. All piping used on this project shall be both UL listed and FM approved.
 - 4. Fire Department/Marshal Compliance: Install fire protection systems in accordance with local regulations of University Fire Department and State Fire Marshal.
 - 5. Screw Thread Connections: Comply with local fire department/marshal regulations for sizes, threading, and arrangement of connections for fire department equipment to systems.
- C. The automatic sprinkler system shall conform to the requirements of the 2001 Edition of the California Building Code Standards, or latest adopted edition by authority having jurisdiction.
- D. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system) have been reviewed and approved by the University Fire Department.
- E. Reference Standards:
 - 1. FS: Federal Standards

- a. WW-P-406D: Pipe, Steel (Seamless and Welded) (For Ordinary Use).
- b. WW-P-521G: Pipe Fittings, Flanged Fittings, Flanges, Ferrous and Steel (Screwed and Butt-Welded).
- c. WW-P-501E: Pipe Fittings, Cast Iron, Screwed 125 and 250 Pound.

1.04 SUBMITTALS

- A. Reflected Ceiling Plans: Provide Drawings showing location of all sprinkler heads throughout the building or project area and their relationship to all other materials forming part of the ceiling system. No fire sprinkler piping shall be shown on these Drawings. Submit drawings to University's Representative prior to any other work.
 - 1. Submit six sets of sprinkler location Drawings in all areas. Prepare these Drawings prior to the preparation of Engineered Drawings required herein before. Superimpose these Drawings upon reflected ceiling plans and show ceiling module, light fixtures, air inlets and outlets, and tile pattern where applicable.
 - 2. Adjustments by the University's Representative in these head locations are to be anticipated by the Contractor and shall be allowed for in bidding. No extra compensation will be allowed for spacing of sprinklers closer than the maximum area of coverage allowed by NFPA 13 where it is necessary to suit the ceiling module and lighting layout.
- B. Drawings: Prepare Shop Drawings and product data of fire protection systems indicating pipe sizes, pipe locations, fittings, shutoffs, equipment, etc. Submit to University's Representative for review. Submit six reviewed sets to agency having jurisdiction, with Architect / Engineer stamp shown on each drawing before proceeding with installation. Include CSFM listing number on products submitted for review.

- C. Calculations: Prepare hydraulic calculation of fire protection systems. Submit to University's Representative for review. Submit six reviewed sets to authority having jurisdiction, with Architect's/ Engineer's stamp shown on each drawing and/or signature of agency having jurisdiction, before proceeding with installation.
- D. Product Data: Submit manufacturer's original technical product data (not photocopies) for fire protection materials and products with CSFM listing numbers as part of submittal to University's Representative. Clearly identify components intended for use. Submit six reviewed sets with Architect's / Engineer's stamp and signature to authority having jurisdiction.
- E. Record Drawings: Using the fire sprinkler system as-built drawings and your own records of any other pertinent changes during construction, apply the information to produce a facility set of Record Drawings on CAD for the University document archives. Include as part of these drawings products and site information including supply pressures. The University will receive CAD drawings via appropriate electronic transmission medium, and one set of full-size reproductions plotted on 4-mil thick wash-off polyester drafting film with matte finish. These drawings shall be clearly labeled "Fire Sprinkler System Record Drawings". Computer CAD files shall be fully compatible with the University CAD system. The University will provide direction for CAD standards to be used for document deliverables. (Also see Division 1, General Requirements, Sections 017700 Closeout Procedures and 017800 Closeout Submittals).
- F. Maintenance Data: Submit maintenance data and parts lists for fire protection materials and products. Include this data, product data, drawings, calculations, certificate of installation, and Record Drawings in maintenance manual in accordance with requirements of Division 1.
 - 1. Certificate of Installation: Submit certificate upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13 and NFPA 14 and that system is operational, complete, and has no defects.
- G. Provide a list of control valves, drains and inspectors test valves. The list shall be in a matrix format and provide the room number where the valve or drain is located and size of valve or drain.

PART II - PRODUCTS

2.01 GENERAL

- A. Provide new piping materials and factory-fabricated piping products of sizes, types, pressure rating, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Contractor to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems. Where more than one type of material or product is indicated, selection is Contractor's option.
- B. Equipment to be furnished under this specification shall be standard product of manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer. However, component parts of system need not be products of same manufacturer.

2.02 BASIC IDENTIFICATION

- A. Provide identification complying with Division 15 Basic Mechanical Materials and Methods section in accordance with the following listing:
 - 1. Fire Protection Valves: Brass valve tags.
 - 2. Fire Protection Signs: Provide the following signs:
 - a. At each sprinkler valve, including roof manifold, sign indicating what portion of system valve controls.
 - b. At each outside alarm device, sign indicating what authority to call if device is activated.

2.03 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipes and pipe fittings complying with Division 15 Basic Mechanical Materials and Methods section in accordance with the following listing:
- B. Pipe
 - 1. For installation below ground - ductile iron, Federal Specification WW-P-421d, Type I, II, III, Class 200.
 - 2. At contractor's option, piping more than 2' from building may be Polyvinyl chloride (PVC) water pipe; Class 200, DR-14; cast-iron or ductile-iron fittings, ring-tile joints. Pipe shall be listed as AWWA C900.
 - 3. For installation above ground, steel pipe, Federal Specifications WW-P-406, Type I, Class A, black.
 - 4. Schedule 10 piping may be used subject to review by University Fire Department.
 - 5. Threadable thin wall pipe is prohibited.
- C. For installation above ground - Schedule 40 black steel pipe - in accordance with ASTM A 135 and A 53.
 - 1. At contractor's option, pipe may be steel Schedule 10 black; in accordance with ASTM A 135.
- D. Pipe Fittings:
 - 1. For installation below ground - For use with cast iron pipe, American Water Works Association Standard Specification C100, Class D, 200 pounds; or listed as approved by Underwriters' Laboratories, Inc., list of Inspected Fire Protection Equipment and Materials or approved by any other appropriate, nationally recognized testing laboratory for use in sprinkler system.
 - 2. For installation above ground, Federal Specification WW-P-501, Type I, Class A piping. Exterior piping must be protected against freezing.

2.04 BASIC PIPING SPECIALTIES

- A. Provide piping specialties complying with Division 15 Basic Mechanical Materials and Methods section in accordance with the following listing:
 - 1. Pipe escutcheons
 - 2. Dielectric unions
 - 3. Pipe sleeves
 - 4. Sleeve seals

2.05 BASIC SUPPORTS AND ANCHORS

- A. Provide supports and anchors complying with Division 15 Basic Mechanical Materials and Methods sections, in compliance with NFPA Pamphlet No. 13.
- B. Provide calculations and details for support and bracing members and connections not covered by NFPA 13, or where applicable, refer to the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems".

2.06 BASIC VALVES

- A. Provide valves complying with Division 15 Basic Mechanical Materials and Methods sections, in accordance with the following listing:
 - 1. Interior Valves:
 - a. Sectional: Gate valves or butterfly valves; UL listed.
 - b. Check: Swing check valves; UL listed.

2.07 SPECIAL VALVES

- A. Provide valves, UL listed, in accordance with the following:
 - 1. Provide sizes and types which mate and match piping and equipment connections.
 - 2. Alarm Check Valve: Provide cast iron water flow alarm check valve, 175 psi working pressure.
 - 3. Hose Outlet Valves: Provide angle hose valves, 2-½" size where not otherwise indicated. Hose threads shall match the requirements of the Sacramento Fire Department. Provide bronze cap and chain at each valve location.
- B. Manufacturers: Grinnell Fire Protection Systems Company, Inc., Grunau Sprinkler Manufacturing Company, Inc., Guardian Fire Equipment, Inc., Seco Manufacturing, Inc.,

Stockham Valves and Fittings., Western Fire Equipment Company; Division of Premier Industrial, or equal.

2.08 BASIC METERS-GAUGES

- A. Provide meters and gauges complying with Division 15 Basic Mechanical Materials and Methods sections, in accordance with the following listing:
 - 1. Pressure gauges, 0-250 psi range.

2.09 FIRE PROTECTION SPECIALTIES

- A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which match piping and equipment connections.
 - 1. Install drains on main risers and auxiliary drains at all low points in the system.
 - 2. At least one inspector's test drain shall be installed for each sprinkler system.
 - 3. Drains and inspector's tests shall be of number and at locations directed and approved by the University Fire Department.
 - a. Provide drain line to floor sink or to outside, as required, to suit Project conditions. Floor sink must be able to accommodate water from drain line with valve in fully opened position without spillage onto floor.
 - 4. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting.
 - 5. Drain valve shall be of the angle type. Install in accordance with the requirements of NFPA Pamphlet No. 13.
 - 6. Pipe drain valves to the outside of the building. Discharge shall be visible from sight drain fitting or open-end drain pipe. Provide flushing connections at ends of all cross mains.
- B. Flow Alarm: Furnish and install an alarm bell for each building and a flow switch for each sprinkler zone. The systems shall be complete with a Grinnell F-620 or equal, CSFM listed, flow switch. Each sprinkler zone shall have a check valve installed to isolate the water flow switch from the riser. In addition, the main riser shall have a UL approved 10" bell and a marked switch box with lock and wiring connected to Fire Alarm Control Panel. Flow switch and supervisory alarms shall alarm to FACP. The Contractor shall be responsible for wiring between switch, bell, and junction box. Provide junction box under Division 16. Wiring shall meet the requirements of Division 16. All controls shall be identified by permanent metal tags or other approved means. Alarm switch shall be UL or FM approved and shall have adjustable retard mechanism and two sets of contacts. Wiring between electrical distribution panel and junction box will be provided under Division 16.
- C. Supervisory Switch: Fit the control valves on the fire sprinkler risers with monitor switch, Grinnell Model F640 or equal, CSFM listed, with single pole double throw switch actuator

installed to change switch position when OS&Y valve is being closed or opened as required for fire pumps.

- D. Manufacturers: Grinnell Fire Protection Systems Company, Inc., Grunau Sprinkler Manufacturing Company, Inc., Guardian Fire Equipment, Inc., Potter Roemer, Inc., Western Fire Equipment Company; Division of Premier Industrial, or equal.

2.10 AUTOMATIC SPRINKLERS

- A. Provide automatic sprinklers in accordance with the following listing. Provide fusible links for 165°F. unless otherwise indicated or directed by University Fire Department.
- B. Type: Spray-pattern type, automatic closed-type heads of ordinary degree temperature rating, except that sprinklers to be installed in vicinity of heating equipment or in skylights shall be of temperature ratings required for such locations by University fire Department.
- C. Type of Sprinklers:
1. Exposed Locations: Provide upright type heads at all areas with no finished ceilings, Automatic Sprinkler Corporation of America, Model J-2.5, or equal, no known equal.
 - a. Where heads are located at height of less than 8' above finished floor, provide wire guards to protect heads from damage.
 2. Concealed Locations: Provide upright-type heads or pendent-type heads Automatic Sprinkler Corporation of America, Model J-2.5, or equal, no known equal.
 3. Sidewall Locations: Where required and where approved by the University's Representative shall be Automatic Sprinkler Corporation of America, Model J-2.17, or equal, no known equal.
 4. Finished Ceilings: Locate at all ceilings with lay-in acoustical tile ceiling and at plaster or gypsum board type ceilings.
 - a. Provide satin chrome finish and white ceiling plates. Automatic Sprinkler Corporation of America, Model J-2.23, or equal, no known equal.
 5. All sprinkler heads provided shall be appropriate for the building conditions.
 6. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store sprinklers and wrench sized to sprinklers. Spare sprinklers and wrenches called for under "Extra Stock." Location to be determined by University Fire Department.
- D. Manufacturers: Automatic Sprinkler Corporation of America, Central Sprinkler Corporation, Grinnell Fire Protection Systems Company, Inc., Star Sprinkler Corporation, or equal.

2.11 SIAMESE CONNECTIONS

- A. Provide free-standing type cast brass siamese connections and escutcheon plate assembly, with fire department inlets with hose connections as required by local authority. Provide 6" rough chrome plated inlet and body equipped with individual drop clapper

valves, brass plugs and chains, and constructed with the following additional construction features:

1. Finish: Polished Chrome Plated, or as determined by University's Representative.
 2. Cast Lettering: "AUTO. SPKR." Additional wording may be required by University Fire Department.
 3. Escutcheon As required to suit number and size of inlets.
 4. Where indicated on the Drawings, provide a wafer style check valve, above grade in the riser to the siamese connection. Provide a ball drip above grade, on the siamese side of the check valve.
- B. Manufacturers: Allen (W.D.) Manufacturing Division; J.W. Moon, Inc., Croker-Standard Division; Fire-End Croker Corporation, Elkhart Brass Manufacturing Company, Inc., or equal.

2.12 TESTS

- A. The pump shall be hydrostatically tested to 1-½ times the working pressure, but in no case less than 250 PSI. The pump unit shall be given a complete performance test in the presence of the University's Representative and the University Fire Department Representative, and characteristic curves prepared from the test results shall be submitted for review by the University Fire Department.

2.13 VENTURE LOOP

- A. Fire pump shall have a closed loop for testing, including a 5" Venturi and wall mounted meter reading directly in GPM.

PART III - EXECUTION

3.01 LOCATION OF EQUIPMENT AND VALVES

- A. Provide fire department connection to building where indicated on Drawings.
- B. Provide zone valves and sprinkler systems as shown on contract drawings and specified by the University Fire Department. Provide zone valves less than 7 feet above finished floor unless approved by UCDHS Fire Department.

3.02 INSPECTION

- A. Examine areas and conditions under which fire protection materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.03 INSTALLATION OF BASIC IDENTIFICATION

- A. Install mechanical identification in accordance with Division 15 Basic Mechanical Materials and Methods section.
- B. Install fire protection signs on piping in accordance with NFPA 13 and NFPA 14 requirements.

3.04 INSTALLATION OF PIPES AND PIPE FITTINGS

- A. Install pipes and pipe fittings in accordance with Division 15 Basic Mechanical Materials and Methods section.
- B. Comply with requirements of NFPA 13 and NFPA 14 for installation of fire protection piping materials. Install piping products where indicated, in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that piping systems comply with requirements and serve intended purposes.
- C. Coordination: Coordinate all piping, heads, and sprinkler work to Architectural, Structural, Mechanical, and Electrical Work. Conceal piping, except where so indicated otherwise or where absolutely necessary. Place exposed piping where required by the University's

Representative. Provide any offsets or additional piping required to coordinate this system with all other Work.

- D. Any differences or disputes concerning coordination, interference, or extent of work shall be decided by University and this decision shall be final.
- E. Supply System: Provide supply connections as required to service the sprinkler system.
- F. Installation shall conform to the applicable requirements of NFPA pamphlet Number 13.
 - 1. Details of bracing must comply with the SMACNA "Guidelines for Seismic Restraint of Mechanical Systems and Plumbing Piping Systems", and OSHPD if project is under their jurisdiction.
- G. Make connections to water stub covered in civil work with fittings suitable for the particular conditions encountered.
- H. Provide changes in direction with anchors or thrust blocks. Terminate supply lines inside buildings with a special flange and spigot piece, with flange set not less than 4" above floor.
 - 1. Install a blank flange temporarily on flange to prevent entrance of foreign matter into supply line.
- I. Make joints as specified herein and in a manner approved by University Fire Department. Leave joints exposed until final inspection and tests have been made.
- J. Brace or clamp bends in accordance with the requirements of NFPA Pamphlet 13. The clamp rods at the flange and spigot piece shall be long enough to pass through the flange.
- K. Before connection of sprinkler system to underground supply, flush supply connections out thoroughly in accordance with NFPA 13.
- L. Excavation and backfill is a part of this work and shall be as specified in Division 15, Basic Materials and Methods sections. Depth of cover shall be in accordance with NFPA 24.
- M. Piping and Fittings Above Ground:
 - 1. Install pipe, fittings, and hangers in accordance with requirements of NFPA Pamphlet No. 13.
 - 2. Cutting structural members for passage of sprinkler piping or for pipe hanger fastening will not be permitted except on review of the Structural Engineer as well as University's Representative for each specific case.
 - 3. Holes through walls, floors, and ceilings shall be large enough to accommodate pipe expansion. Provide approved fire penetration protection at each hole to

maintain the fire rating of floor or wall. Foundation penetration shall have a 2" clearance all the way space around pipe and sealed watertight.

4. Provide long runs of pipe with suitable means to permit free movement due to expansion and contraction.
5. Make reduction in pipe sizes with one-piece concentric tapered reducing fittings. Bushings will not be acceptable.
6. Couplings shall not be used except where the length of pipe between fittings exceeds 20'.
7. Use flanged fittings in control valves and drain assembly and at the base of risers.
8. Use malleable iron unions of the ground joint type in looped sprinkler systems where pipe is 2" in diameter or smaller. Where loops larger than 2" are used, companion flanges shall be installed.
9. Install sectional valves in inlet piping, at bottom of each riser, and in all loops as required.
10. Mount supervisory switches on each sectional valve.
11. Install pressure gages at top of each standpipe.
12. Install valved hose connections $\frac{3}{4}$ " size on sprinkler at ends of branch lines and cross mains.
13. Install inspector's test connection at most remote point from riser or as approved by the University Fire Department.

3.05 INSTALLATION OF SPRINKLERS IN FINISHED CEILINGS

- A. Where heads are located in grid or tile ceilings with regular pattern, heads shall be in center of tile or grid measured in both directions.

3.06 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 and University Fire Department. At completion, carefully clean and adjust equipment and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.07 FIELD QUALITY CONTROL

- A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections, and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not

clogged sprinklers. Test the fire sprinkler system floor by floor prior to covering the pipe. Once each floor is tested the entire system will then be tested.

- B. Hydrostatic Testing: After flushing entire system, test fire sprinkler piping hydrostatically for period of 2 hours at not less than 200 psi or at 50 psi greater than system pressure where pressure is anticipated to be in excess of 150 psi in the presence of the California State Fire Marshal and the University Fire Department Representative. The system will not have visible leaks. Any visible leaks shall be repaired and system will be retested. Measure hydrostatic pressure at low point of each system or zone being tested.

3.08 ADJUSTING AND CLEANING

- A. Cleaning and Inspecting: Clean and inspect fire protection systems in accordance with requirements of Division 15 Basic Mechanical Materials and Methods sections.

3.09 EXTRA STOCK

- A. Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units but not less than 10 heads, in proportion to the total number of each style of head.
- B. Wrenches: Furnish two sprinkler wrenches for each type and size of sprinkler connection.
- C. Obtain receipt from University that extra stock has been received.

3.10 OPERATION TEST

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.
- B. Contractor shall provide for University Fire Department final inspection of the sprinkler system with the following:
 - 1. Approved fire sprinkler drawings, including supply from site and site supply pressures.
 - 2. Specifications of installed products indicating all applicable UL numbers.
 - 3. Specifications of all fire stopping materials and assembly details in addition to California State Fire Marshal approved assembly numbers as appropriate.
 - 4. Contractor's material and testing certificate with all information complete and accurate.

3.11 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 153000





SECTION 154000
PLUMBING PIPING SYSTEMS

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of plumbing piping systems specified in this section include the following:

1. Water Piping
2. Vent Piping
3. Piping Specialties
4. Valves
5. Cleanouts
6. Trap Primers
7. Hose Bibbs

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required for project.

C. Requirements of Regulatory Agencies:

1. Plumbing Code Compliance: Comply with applicable portions of Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products.
2. Standards and Codes: Latest adopted edition by authority having jurisdiction.
 - a. Uniform Plumbing Code
 - b. AWWA 9th Edition
 - c. NFPA 99
 - d. CA Code of Regulations, Title 17
 - e. CA Code of Regulations, Title 24
 - f. SMACNA Guidelines and Standards
 - g. Fed OSHA Title 29, Cal OSHA Title 8 or CA Labor Code

3. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.
4. CMC Compliance: Fabricate and install natural gas systems in accordance Uniform Mechanical Code 200 addition.

1.03 QUALITY CONTROL

- A. Workmanship: Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship. Provide suitably qualified personnel to produce work of specified quality. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.
 1. All materials, equipment, devices, etc to be installed on project shall be factory manufactured, no exceptions taken.
 2. All materials, equipment, etc. to be used for permanent installation purposes shall be new. No used materials, equipment, etc. shall be allowed.
 3. No item submitted on by the Contractor shall be of a lesser quality in materials or performance than what is in the project specifications.
- B. Record Drawings: At project closeout, submit As Built Drawings of installed piping systems, in accordance with requirements of Division 1.
- C. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

PART II - PRODUCTS

2.01 MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with Uniform Plumbing Code.

2.02 BASIC PIPES AND PIPE FITTINGS

- A. Provide pipes and pipe fittings complying with Division 15 Mechanical Materials and Methods section "Pipes and Pipe Fittings," in accordance with the following listing:

1. Interior Water Piping:
 - a. Tube Size 1-1/4" and Smaller: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder joints.
 - b. Tube Size 1-1/2" and Larger: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, brazed joints. This includes all pressure systems, all brazing by certified brazer only.
 - c. All heating water copper pipe joints shall be brazed.
 - d. Rubber gaskets shall NOT be used in any domestic water system.
2. Above Ground Building Drain Piping:
 - a. Cast-iron hub-and-spigot soil pipe; service weight; cast-iron, hub-and-spigot soil pipe fittings, compression gasket joints.
 - b. Hubless cast-iron soil pipe; service weight; hubless cast-iron soil pipe fittings. Cast iron waste lines to be stainless steel four band no-hub Husky bands minimum as determined by pipe size, or equal, no know equal. Standard stainless steel four band no-hub bands to be used on vent systems only, no exceptions taken.
3. Vent Piping:
 - a. Sizes 2-1/2" and smaller; hubless cast-iron soil pipe; service weight; hubless cast-iron soil pipe fittings, or type L hard drawn copper tubing with cast bronze solder joint fittings and lead free solder. Standard stainless

steel four band no-hub bands to be used to vent systems only, no exceptions taken.

- b. Sizes 3" and larger; cast iron soil pipe and fittings as specified above or Type L hard drawn copper tubing with cast bronze solder joint fittings and lead free solder may be used above ground. Provide test tees as specified.
 - c. Vent piping below slab to be hubless cast iron, see 5b below.
4. Underground Building Drain Piping:
- a. Cast-iron hub-and-spigot soil pipe; cast-iron hub-and-spigot soil pipe fittings. Provide neoprene gasket at each hub.
 - b. Hubless cast-iron soil pipe; service weight; hubless cast-iron soil pipe fittings, hubless joints with cast-iron bolted couplings and neoprene

gasket, or stainless steel four band no-hub Husky bands minimum as required by pipe size, to match campus standard.

2.03 BASIC VALVES

- A. Provide valves complying with Division 15 Basic Mechanical Materials and Methods sections, in accordance with the following listing:
 - 1. Sectional Valves:
 - a. 2" and Smaller: IPS full port ball valves.
 - b. 2-½" and Larger: butterfly valves.
 - 2. Shutoff Valves:
 - a. 2" and Smaller: IPS ball valves, only.
 - b. 2-½" and Larger: Butterfly valves, only.
 - 3. Drain Valves:
 - a. 2" and Smaller: IPS ball valves.
 - b. 2-½" and Larger: Ball valves.
 - c. Hose bids are not to be used as drain valves on low point drains, equipment, etc.

2.04 HOSE BIBBS

- A. Where located on interior walls: Polished bronze body, chrome plated, renewable composition disc, tee handle, ¾" hose outlet with non-removable vacuum breaker.
- B. Where located on exterior walls: Rough bronze body, chrome plated, renewable composition disc, tee handle, ¾" hose outlet with non-removable non-freeze vacuum breaker.
- C. Manufacturer: Zurn or equal.
- D. Hose bibs to have upstream SOV to repair or replace hose bib at branch line serving hose bib only.

2.05 TRAP PRIMER

- A. Provide trap primers as indicated ½" size, with built-in air gap and ½" shut-off valve upstream of trap primer.
 - 1. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps.
- B. Manufacturers: Zurn or equal.

2.06 CLEANOUTS

- A. General: Cleanouts of same diameter as pipe shall be installed in all horizontal soil and waste lines where indicated at all points of change in direction. Cleanouts shall be located not less than 18" from building construction so as to provide sufficient space for rodding. End of line COs to be wall COs above floor rim of fixtures. No cleanouts are allowed in ceiling areas. Cleanouts shall be Zurn as indicated below or equal. Manufacturers: Zurn, J. R. Smith, or equal.
 - 1. Wall cleanouts instead of floor cleanouts above flood rim where battery of fixtures exists (water closets, clinic sinks, etc.)
 - 2. All sinks shall be provided with a cleanout above flood rim at the sink location.
- B. Cleanouts shall have cast iron ferrules and bronze plugs.
- C. Cleanouts extending to floor level shall be provided with membrane flange and clamping collar, bronze raised head plug, and nonslip scoriated top.
 - 1. Cleanouts in cast-iron soil or waste lines: Zurn Z-1440A-BP, Smith, or equal.
 - 2. Cleanouts in walls: Zurn Z-1445-1-BP with stainless steel access cover, Smith, or equal.
 - 3. Cleanouts on exterior of building: Zurn Z-1440-BP, Smith, or equal.
 - a. Provide stainless steel cover and vandalproof screw where located in wall. Zurn Z-1445-1-BP, Smith, or equal.
 - b. Where located at grade, provide 18" x 18" x 6" concrete pad and Zurn Z-1474 heavy duty cover. Provide Z-1440-BP cleanout, Smith, or equal.
 - 4. All wall cleanouts shall be Zurn ZN-1400-BP, Smith, or equal.

PART III - EXECUTION

3.01 INSPECTION:

- A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.02 INSTALLATION OF WATER PIPING:

- A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.
- B. Use shock trolls at fixtures. Where fixtures are located in a row or battery, the water supply header may be continued full size of the branch outlet shock trolls to be accessible through access door or lift out ceiling.
 - 1. Properly sized, bellows-type air chambers. All materials used in construction of bellows type air chambers must be stainless steel IPS threaded construction and

shall have S.O.V. upstream of air chamber. Zurn Z-1700 Series Arrestor, Smith, or equal.

- C. Install piping on room side of building insulation.
- D. Water lines shall not be installed in the same trench with non-metallic sewer lines unless the bottom of the water pipe at all points is at least 12" above the top of the sewer line and the water line is placed on a solid shelf excavated at one side of the common trench.
 - 1. Where water and waste piping cross, the pipes shall have no fittings within 10' of the crossing, and the water line shall be run above the waste line. Comply with any local codes or requirements.

3.03 INSTALLATION OF SANITARY DRAINAGE SYSTEMS

- A. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than $\frac{1}{4}$ " per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- B. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than $\frac{1}{4}$ " per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- C. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45° or less.
- D. Grade all vent piping so as to free itself quickly of any water condensation.
 - 1. Where possible, join groups of vent risers together with one enlarged outlet through roof.
- E. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.
 - 1. Drip pans located directly below hydronic piping or similar sources of possible damage shall be provided to protect electrical and electronic work which is sensitive to moisture. Pans shall be 2" deep, extending a minimum of 6" beyond each edge of overhead piping and lengthwise 18" beyond each side of electrical work to be protected. Fabricate pans of either 20-gauge copper or 16-gauge zinc-coated steel, with rolled edges and reinforced for proper support, soldered fully watertight, and fitted with a $\frac{3}{4}$ " copper drain pipe properly discharged.
 - 2. Mechanical work drip pans shall be provided for roof and overflow drain, and sanitary soil and waste piping located above food preparation centers, food service

facilities, food storage areas, and other critical areas to protect the areas below.
Drip pans shall be constructed as specified for electrical work pans in E1 above.

- F. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions and in accordance with CISPI Pamphlet No. 100, latest edition.
- G. Bell & Spigot Vitrified Clay Soil Pipe: Comply with pipe manufacturer's installation instructions.

3.04 INSTALLATION OF DRAINAGE PIPING PRODUCTS

- A. Cleanouts: Install in piping as indicated, as required by Uniform Plumbing Code, at each change in direction of piping greater than 45°, at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping, and at base of each conductor.
 - 1. Cleanouts in ceilings will not be accepted as to be serving fixtures or counted as a drain line cleanout.
 - 2. Wall cleanouts instead of floor cleanouts above flood rim where battery of fixtures exists (water closets, clinic sinks, etc.)
 - 3. All sinks shall be provided with a cleanout at the sink locations, installed above the overflow of the fixture. All sinks means the entire project.
- B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.
- C. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains and floor sinks with lip of drain slightly below finished floor to ensure drainage. Coordinate with other Contractors to ensure that floor slopes to drain.

3.05 INSTALLATION OF VALVES

- A. Install valves as indicated on Drawings and in the following locations:
 - 1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
 - a. Shutoff valves in ceilings, walls, floors, shall be accessible thru access doors, ceiling lift-out tiles (finished ceiling) within arms reach, 24" max reach from opening to valve handle.
 - 2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.
 - a. Install low point drains on all piping at the lowest point in the system to enable the total drain down of the system for the purpose of repairs, retrofits or remodels. Lines from 4" thru 10" pipe shall have a 2" low point drain and 2" SOV. Lines 2" thru 3-½" shall have a 1-½" low point drains

and 1-½" SOV. Smaller size lines use line size low point drains and SOV's. Include plus in end of shutoff valves.

- b. Hose bibs are not to be used as drain vales on low point drains, equipment, etc.

3.06 INSTALLATION OF TRAP PRIMERS

- A. Install as indicated in manufacturers printed literature, with ½", type-L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings.

3.07 SPARE PARTS

- A. Furnish to University, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

3.08 DOMESTIC WATER SYSTEM STERILIZATION

- A. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter.
- B. After flushing, sterilize entire water system from new point or points of connection before being turned over to University for use. Slowly fill system with water and add chlorine chemical agent to produce a minimum of 50 PPM of chlorine in entering water. Under current interpretation an Agricultural pest control business license is required to perform water chlorination/disinfection for hire on potable water lines. The most appropriate pest control category possessed by the qualified applicator licensee to supervise the pest control operations of that type of business is Category A - Residential, Industrial and Institutional Pest Control. This license requirement includes all underground piping and all piping in buildings, new remodel and retrofit systems.
- C. Retain treated water in pipe for a minimum of twenty-four hours. Should chlorine residual at pipe extremities be less than 50 PPM at this time, pipe shall be re-chlorinated.
- D. After chlorination, flush lines of chlorinated water and refill from domestic supply. Continue flushing until residual chlorine is not greater than 0.2 PPM at all pipe extremities.
- E. Testing agencies shall be hired by UCDMC to certify all systems installed by vendors (contractors). Contractor shall not hire any certifying agency.

- F. And agricultural pest control business license, Category A-residential, industrial, and institutional pest control, is required to perform potable water chlorination/disinfection. This license requirement includes all underground piping and all piping in new buildings, remodel, or retrofit.

END OF SECTION 154000





**SECTION 154400
PLUMBING FIXTURES AND TRIM**

PART I - GENERAL

1.01 WORK INCLUDED



- A. Types of plumbing fixtures required for the project include the following:

1. Water Closets
2. Lavatories
3. Sinks
4. Electric Water Coolers



1.02 QUALITY ASSURANCE

- A. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this section:

1. California Plumbing Code – CPC
2. American National Standards Institute – ANSI
3. Federal Standards – FS

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1. No item submitted by the Contractor shall be of a lesser quality in materials or performance than what is in the project specifications.

- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of material listed in this section. Include this data and product data in maintenance manual.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handle plumbing fixtures carefully to prevent breakage, chipping, and coring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART II - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PLUMBING FIXTURES

- A. All fixtures shall be first class in every respect. Accurately line up finished plumbing. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
- B. Consult Drawings for locations, dimensions and mounting height of plumbing fixtures.
 - 1. Take location and mounting heights for roughing-in from Drawings.
 - 2. Follow schedule on Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
 - 3. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.
- C. Provide all water supplies to fixtures with shut-off stops with IPS inlets with threaded brass nipples at pipe connection and lock shield-loose key. Provide combination fixtures with I.P.S. stop on each water supply fitting. Provide loose key handle for each stop.
 - 1. Provide $\frac{3}{8}$ " risers for all fixtures, unless otherwise noted.
- D. Furnish shut-off valves on hose bibbs directly connected to mains with no intervening valves.
- E. Concealed Stops: American Standard 7583.016, Chicago, or equal.
- F. Except where otherwise specified, all finish for exposed metal trim on fixture shall be polished chromium plated. This also applies to wall flanges, nuts, and washers. Handles on all faucets and stops shall be all-metal chromium plated.
- G. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene-type gaskets (wall-hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.
- H. Provide fixtures not having integral traps with "P" traps of chromium-plated cast brass connected to concealed waste in wall and sanitary fittings. Provide 17-gauge minimum traps and tailpieces.
- I. Manufacturers: Zurn or equal.
- J. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets.

2.02 PLUMBING FIXTURE HANGERS AND SUPPORTS

- A. Properly install and support plumbing fixtures as required and specified herein.
- B. Carriers and supports shall be Zurn, J.R. Smith, or equal as recommended by manufacturer for the particular installation and type of fixture being installed.
 - 1. Residential-type fixture supports are not acceptable.

- C. Install wall-mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.



- D. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.

1. Electric water coolers

- a. Backing supports (plates) in walls for fixtures, faucets, foot valves, basins, and supporting brackets, etc., shall be ¼" thick steel plate.

- E. Install wall-hung lavatories in stud walls with concealed arms and floor support, with feet of support securely anchored to floor. In addition, anchor top of support to wall construction in an approved manner.

1. Backing supports (plates) in walls for fixtures, faucets, foot valves, basins, and supporting brackets, etc., shall be ¼" thick steel plate.

2.03 WATER CLOSET SEATS

- A. Provide seats for standard elongated bowls with self sustaining check hinges, stainless steel posts, stainless steel nuts and washers, white color. Zurn Z-5956SS-EL-STS or equal.

2.04 PLUMBING FIXTURES



- A. Fixtures shall be American Standard, Zurn, or equal.



- B. Plate numbers indicated are American Standard, Zurn, or equal, complete as illustrated and described, unless otherwise noted. Provide stops for all concealed supplies.

- C. Water Closet (WC-1): Zurn Z-5615 1.28 GFP Wall Hung Topspud Flushvalve Bowl with Zurn Z-6000AV-WS-1 or ZER-6000AV-TM-HW sensor hard wire flush valve containing a TPE chloramine resistant filtering diaphragm and Zurn Z-5956SS-EL premium OFLC seat or equal.

1. Where used for handicapped water closets, the flush valve shall be mounted on the wide side of the toilet enclosure.



- D. Lavatory (L-1): American Standard Aqualyn No. 0476.028 20 x 17 Counter Mount vitreous china lavatory with Chicago 116.103.AB faucet with ceramic disk and temperature limit stop, Zurn Z-8701B-PC 1-¼ x 1-½ semi cast P-trap with cleanout, Zurn Z-8743 1-¼ grid drain or equal. For handicapped application use Zurn Z-8746 offset grid drain and insulate hot water and drain piping exposed below lavatory as required in Section 15250 – Mechanical Insulation. Provide 0.5 GPM flow restrictor at aerator or in supply line, or equal.

- E. Sink (S-1): Just Manufacturing model JPHADA2230-CT-J stainless steel 30"x22"x27" wall hung ADA sink enviro kit with eyewash. Provide separate thermostatic mixing valve for faucet and eyewash fixtures. Faucet shall be manufacturer included gooseneck wall mounted sensor faucet. Provide manufacturer included swing down eyewash. Provide manufacturer included drain and p-trap.

- F. Sink (S-2): Just Manufacturing model US1620A-J stainless steel 20-1/2"x16-1/2"x7-7/8" single bowl undermount sink, 18 gauge 304 stainless steel, center drain, sides and bottom pads or equal. Faucet shall be Chicago 786-GN8AFCABCP manual gooseneck faucet with



1.5 gpm non-aerating laminar flow spout, 8" centers, 4" wrist blade handles. Provide undercounter support for bottom of sink basin. Provide Just J-ADA-35-SSF-VR drain, Just JTS-150 P-trap or equal.

- G. Sink (S-3): Just Manufacturing Model A33338S-J stainless steel 22"x19"x5-1/2" wall hung lavatory sink, 18 gauge 304 stainless steel with buffed satin finish, rear center drain, and bottom pads, or equal. Provide Chicago 116.103.AB.1T sensor operated, hard wired, 0.5 gpm non-aerated laminar flow, gooseneck faucet or equal. Provide Just J-ADA-35-SSF-VR drain, Just JTS-150 P-trap or equal. Insulate exposed water and waste under sink.
- H. Sink (S-4): Elkay Model LRAD252165PD stainless steel 25"x21-1/4"x6-1/2" single bowl drop in ADA sink, 18 gauge 304 stainless steel with satin finish, rear center drain, bottom pads only. Provide with Chicago 436-ABCP deck mounted manual kitchen faucet, 1.5 gpm laminar flow outlet or equal. Provide Elkay LKPDAD18B perfect drain brass body strainer and LKADOS tailpiece.
- I. Electric bottle filler (BF-1): Elkay Model LZWSSM with stainless steel finish and vandal-resistant stainless steel bottom plates, or equal. Package shall include Elkay water filter. Provide terminal enclosure for power supply. Mount bubblers at heights indicated on Drawings. Locate remote as noted on Drawings.
- J. Delta or Chicago Single Level Operated: 500 - 501, or equal. For hand wash sinks in restrooms, public and private (patient). Faucets shall be domestic made, with washerless spring and cup seal. Zurn Z-81000 Single Level faucet with ceramic disk and temperature limit stop or equal. For hand wash sinks in restrooms, public and private (patient).
- K. Electronic infrared sensor faucets shall be Chicago 680, 652-E or Sloan ESF-20, ESF-30, ESF-770, ESF-700, or Zurn Z-6913, Z-6920, Z-6903-76, Z-6903-75, or equal. Faucets shall have integral battery backup and offer extra long ranging capabilities (-XT) or equal.
- L. Electronic infrared sensor flush valve shall be Sloan Optima Systems 110ES-S, or Zurn ZER-6000AV-WS1-CPM (closet) or Zurn ZER-6003AV-WS1-CPM (urinal), or equal. Flush valve shall operate on battery power and contain a TPE chloramine resistant filtering diaphragm.

2.05 EMERGENCY PLUMBING FIXTURES

A. EMERGENCY EYE/FACE WASH AND SHOWERS

The approved units must be:

1. Supplied by domestic water.
2. Readily visible and accessible to the laboratory or work site. The unit should be located as close to the hazard as possible and cannot be blocked by building structures, cabinets, supplies or equipment.
3. Provided with an activation device, such as stay open ball valve, that allows the user full movement of both hands after the valve is turned on.
4. Identified with a highly visible sign.
5. Drain will be plumbed to sanitary sewer.

6. Located so as not to pose an electrical shock hazard. No electrical outlets within 6 feet unless GFI protected.
7. See Specification Section 116100 for additional information.

 B. 2 EMERGENCY EYE/FACE WASH

Approved emergency eye or eye/face wash units are Haws 7611, Just Manufacturing JG-1800, or Guardian G1805 (laboratory unit – install at sink), Haws 7000BT or Guardian G1750PT (Barrier Free), Haws 7656WC or Guardian GBF 1735DP (recessed), or equal. In addition to the requirements above, the approved units must be:

1. Regulated to provide a spray force of three to six gallons per minute at 30 psi.
2. Mounted such that the water nozzles are 33 inches to 45 inches from the floor level; height should comply with Americans with Disabilities Act of 1990 (ADA) requirements.
-  3. Mounted so that the spray nozzles, when activated, are no more than 18 inches from the counter front when located above work counters or benches.
4. Drain will be plumbed to sanitary sewer.

PART III - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors, substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install plumbing fixtures of types indicated where shown and at mounting height indicated on Drawings in accordance with fixture manufacturer's written instructions, roughing-in Drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Uniform Plumbing Code pertaining to installation of plumbing fixtures.
- B. In all cases where plumbing fixtures are mounted on or against building walls of concrete or other materials having relatively rough or non-planar surfaces, it shall be the responsibility of this Contractor to provide any necessary grout or backing materials required to facilitate fixture mounting and eliminate void spaces between fixtures and wall to ensure adequate bearing contact.
 1. On completion of installation, provide silicone sealer at all points of fixture contact with walls or floors.

- C. Any fixture broken, cracked, or otherwise damaged during installation must be replaced by Contractor at his own expense.
- D. On all handicap fixtures that require user protection from the hot water supply and the P-trap, said items shall be covered with Skal + Gard protective devices, Truebro--Lav Guard, or equal. All materials used shall be fire retardant. Do not use adhesive wrapping on P-trap or angle stops/water supply risers.

3.03 TRAPPING AND VENTING OF FIXTURES

- A. Trap and vent all plumbing fixtures in accordance with Uniform Plumbing Code adopted by the Western Plumbing Officials Association and local plumbing codes, whether or not shown on Drawings. Strictly adhere to any local codes. Only exceptions to above will be those fixtures which are specially noted herein or on Drawings to be provided with special wastes.
- B. No vent shall intersect another vent at a point less than 6" above extreme overflow level of highest fixture served.
- C. Take vents off top half of horizontal runs and grade so as to free vents quickly of any water or condensation.

3.04 ADJUSTMENT OF PLUMBING PIPING SYSTEM

- A. Test and adjust all flush valves so that each fixture receives the proper amount of water. Regulate all faucets, bibbs, drinking fountains, etc. to the approval of the University's Representative so that the entire system is left in first-class condition.
- B. Clean fixtures, equipment, and materials installed under this contract. Remove cement, plaster, paint and/or rust, etc. Dirt, rubbish, paint spots, or grease on walls or fixtures for which this Contractor is responsible must be removed by him.

3.05 CLEAN AND PROTECT

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.

3.06 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match

to be judged by University's Representative. Remove cracked or dented units and replace with new units.

3.07 EXTRA STOCK

- A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to University with receipt. Furnish one device for every 10 units.

3.08 OPERATION TEST

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.09 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 154400





SECTION 158600 FANS AND VENTILATORS

PART I - GENERAL

1.01 WORK INCLUDED

- A. Types of fans and ventilators required for project include the following:

1. Curb Mounted Roof Exhaust Fans

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of material listed in this Section.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of material listed in this Section. Include this data and product data in maintenance manual.

PART II - MATERIALS

2.01 CURB MOUNTED ROOF EXHAUST FANS

- A. General: Provide centrifugal roof type, curb mounted, of type, size, and capacity as scheduled, and as specified herein.
- B. Ratings: Tests and rate fans in accordance with ASHRAE Standards. Provide with AMCA Certified Rating Seal for airflow and sound.
- C. Type: Centrifugal fan, louvered low contour type, direct or belt driven as scheduled. Provide capacitor-start, induction-run type motor for belt driven fans.
- D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
- E. Bird Screens: Provide removable bird screens, 1/2" mesh, 16-gauge aluminum or brass wire.
- F. Dampers: Provide gravity-actuated dampers in curb bases. Provide access to dampers.
- G. Manufacturers: Acme Engineering and Mfg. Corp., Greenheck Fan Corp., Penn Ventilator Co., Inc., or equal.

PART III - EXECUTION

3.01 GENERAL

- A. Install fans and ventilators where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.

- B. Provide motors so that they cannot be overloaded above nameplate rating throughout the full speed range of the adjustable pitch driving sheave.
- C. Fan wheels shall be balanced statically and dynamically near operating speed.
- D. Provide drives and guards conforming to the requirements hereinbefore specified.
- E. Fan construction, speed, noise level, tip speeds, outlet velocities and efficiencies will be taken into consideration in approval of fans offered. Fans shall be as scheduled on drawings, or approved equal.

3.02 ELECTRICAL CONNECTIONS

- A. Ensure air distribution equipment is wired properly, with rotation in direction indicated and intended for proper performance.

3.03 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 and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.04 OPERATION TEST

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

END OF SECTION 158600



**SECTION 158900
DUCTWORK****PART I - GENERAL****1.01 WORK INCLUDED**

- A. Types of ductwork required for this project include the following:
 - 1. Sheet Metal Ductwork
 - 2. Flexible Ductwork
 - 3. Air Plenums
- B. Construct all ductwork located between air handling unit and variable air volume boxes for 4" w.g. pressure class per SMACNA requirements and as listed herein.
- C. Construct all other ductwork for 2" w.g. pressure class, except as noted, per SMACNA requirements.

1.02 QUALITY ASSURANCE

- A. Installer: A firm with at least three years of successful installation experience on projects similar to that required for this work.
 - 1. For work on fiberglass ductwork provide statement from manufacturer indicating that the manufacturer accepts this fabricator to be a qualified fabricator.
 - 2. No fiberglass ductwork; no fiberglass in air stream.
- B. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
- C. ASHRAE Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations, latest edition, for all work in this section.
- D. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- E. Patch, repair or replace ductwork as required. All ductwork shall be made airtight with 1% maximum or less leakage of design flow. Repair or replace ducts and joints as required to the satisfaction of the University's Representative.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork, used for work of this section.
- B. Record Drawings: At project close-out, submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 1.

PART II - MATERIALS

2.01 GENERAL

- A. All standing seams and transverse joints in ALL sheet metal ductwork shall be covered with 4" wide strip of 6-ounce canvas and lagging adhesive to assure airtight joints. Pressure-sensitive tapes not acceptable.
- B. No interior duct liner accepted.

2.02 TWO-INCH PRESSURE CLASS DUCTWORK MATERIALS

- A. Sheet Metal Ductwork: Except as otherwise indicated, fabricate ductwork with commercial grade of galvanized steel.
- B. External Duct Lining:
 - 1. Provide external duct lining only:
 - 2. Oversize duct to maintain low pressure.
- C. Round supply ductwork shall be of the same materials, gauges, and construction as that indicated for 4" pressure class ductwork.
- D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork.

2.03 TWO-INCH PRESSURE CLASS FABRICATION

- A. Shop fabricate ductwork in 4-, 8-, 10- or 12-foot lengths, unless otherwise indicated or required, to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA HVAC Duct Construction Standards, latest edition.
- C. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 15, Section 159100 – Duct Accessories for accessory requirements.
- E. Fabricate round supply connections at rectangular, plenum-type fittings using spin-in type fittings, complete with extractor and volume control damper.
 - 1. Provide spiral-lock seam prefabricated duct, as specified for 4" pressure class. Longitudinal seam duct shall not be used.

2.04 FOUR-INCH PRESSURE CLASS

- A. Sheet Metal: Except as otherwise indicated, fabricate ductwork with commercial grade of galvanized sheet steel.

2.05 FACTORY-FABRICATED, FOUR-INCH PRESSURE CLASS

- A. Spiral lock seam prefabricated factory-build round and oval duct and fittings shall be used wherever possible. Shop-fabricated ducts shall be used only where rectangular shaped ducts are shown on plans or where transitions and special fittings cannot be prefabricated by factory.

- B. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 527 by the following methods and in minimum gauges listed.

1.	<u>DIAMETER</u>	<u>MINIMUM GAUGE</u>	<u>METHOD OF MANUFACTURE</u>
	3" to 14"	26	Spiral Lockseam
	15" to 26"	24	Spiral Lockseam
	27" to 36"	22	Spiral Lockseam
	37" to 50"	20	Spiral Lockseam
	51" to 60"	18	Spiral Lockseam
	Over 60"	16	Longitudinal Seam

- C. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

- D. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams.

1.	<u>DIAMETER</u>	<u>MINIMUM GAUGE</u>
	3" to 36"	20
	38" to 50"	18
	Over 50"	16

- E. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 527, of spiral lockseam construction, in minimum gauges listed.

1.	<u>MAXIMUM WIDTH</u>	<u>MINIMUM GAUGE</u>
	Under 25"	24
	25" to 48"	22
	49" to 70"	20
	Over 70"	18

- F. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams.

1.	<u>MAXIMUM WIDTH</u>	<u>MINIMUM GAUGE</u>
	Under 37"	20
	37" to 50"	18
	Over 50"	16

G. Manufacturers:

1.	<u>MANUFACTURER</u>	<u>PRODUCT</u>
	United Sheet Metal Div., United Magill Corp. Semco Manufacturing Incorporated Air Systems Incorporated - Las Vegas Or equal	Uniseal

2.06 MISCELLANEOUS DUCTWORK MATERIALS

- A. Provide miscellaneous materials and products of types and sizes indicated, and where not otherwise indicated, provide requirements as listed in the latest SMACNA manuals, including proper connection of ductwork and equipment.
- B. Fittings: Unless otherwise shown on Drawings, following fittings shall be used: two-piece, die-stamped, 45° to 90° elbows for sizes up to 8"; five-piece, 90° elbows for sizes over 8"; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.
- C. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- D. Duct Joints: Joint and seal prefabricated, factory-built ducts, fittings, and couplings in strict accordance with duct manufacturer's instructions. Install duct sealers, pop rivets or sheet metal screws and canvas and apply adhesive sealant, Foster SEALFAST, Hardcast Flex-Grip, Childers Chil-Perm or equal, on each joint. Duct sealer shall be fire retardant. Sheet metal screw for joints shall be minimum #10 size galvanized.
- E. Duct Access: Provide access panel sections in prefabricated, factory-built ducts for access to fire dampers, control equipment, etc. as specified in Duct Accessories Section. Access panel size shall be duct diameter wide by duct diameter high for all ducts under 24". Ducts over 24" in diameter shall have 24" x 18" access panels. Minimum size access panels shall be 6" x 6".

2.07 FLEXIBLE DUCTS

- A. Flexible ducts may be used in concealed areas only.
- B. Factory insulate all flexible ducts with 1" thick, one- pound density fiberglass insulation and wrap with factory-installed vapor barrier jacket. Ducts shall be UL approved and tested and meet Class 1 requirements of NFPA 90A. Make elbows to maintain R/W-1.5.
- C. Flexible ducts from rigid runouts to registers shall be Thermaflex M-KE, or equal, with maximum length of seven (7) feet. Flexible duct shall have no bends greater than 45°.
- D. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 1-½" thick fiberglass insulation (K= .25 @ 75°F), encapsulated spring steel wire Helix and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory-fabricated steel connection collars.
 - 1. Make connections to rigid duct and units with draw band and sealer, and then duct tape over outside of sheath.

2. Minimum bend radius shall be twice the duct diameter.
3. Insulated flexible duct shall be attached to collar with a worm drive draw band rated for 175 pounds and inserted a minimum of 1" on to collar. Securely attach insulation and vapor barrier to the collar using a second worm drive draw band rated at 175 pounds. The vapor barrier shall be drawn over the insulation and fastened by the draw band such that no raw insulation is exposed.

2.08 AIR PLENUMS

- A. Construct air plenums designated on the Drawings of factory-fabricated panels or by Contractor-fabrication. In either case, provide all plenum enclosures in this work.
- B. Factory-fabricated panels shall be 4" thick. Industrial Acoustics, United Sheet Metal, or equal. Panels shall be constructed of 20-gauge (min.) galvanized steel solid panels. Entire plenum shall be sealed and caulked airtight in accordance with manufacturer's instructions. Framing members manufactured by panel manufacturer shall be used throughout and connected to base with preset studs with sheet metal screws through framing members as recommended by manufacturer. Plenum shall provide structural rigidity to a minimum of 4" VC pressure differential, either positive or negative.
- C. Fabricate Contractor fabricated panels as recommended by SMACNA Duct Construction Standards for 4" pressure differential.

PART III - EXECUTION

3.01 INSTALLATION OF DUCTWORK

- A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (leakage class 12 for 2" pressure class and leakage class 3 for 4" pressure class) and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling.
- B. Seal ductwork after installation to seal class required and method prescribed in SMACNA "HVAC Leakage Test Manual," latest edition.
- C. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- D. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus- insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2".
- E. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," latest edition, hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2" of movement in all directions with no bending or sagging of the angle.
- F. Balancing dampers shall be installed in all branch ducts and elsewhere as indicated on the drawings.

- G. Use radius elbows in rectangular ducts unless otherwise indicated. Square turn in rectangular ductwork at following locations: immediately upstream from supply air outlets. When required to facilitate installation. Do not install one square turn immediately after another.
- H. All duct work on the high-pressure side of any seam 4" of water or higher shall use government clip or clip and flange with canvas and apply adhesive sealant on each connection.
- I. Medium pressure ductwork (from fan discharge to CAV inlet); Extreme care shall be used in the fabrication and installation of the medium pressure ductwork to insure that it will be airtight. All ductwork shall be tested for leaks in sections as soon as possible and before any insulating.
- J. Medium pressure duct: cap section ends and pressurize to 1-½ times fan static pressure, minimum 4" WC to 10 minutes.
- K. All duct except medium pressure duct: Cap section ends and pressurize to 2" W.C. for 10 minutes.
- L. Do not use flexible duct to connect to any air distribution device or terminal unit (with the exception of registers). Use flex connections where required by code or design for terminal units.
- M. Provide access doors at each change in direction requiring turning vanes, at bottom of risers, and every 50' in horizontal runs. Provide access doors in inaccessible ceilings and walls to gain access to all dampers, terminal units, coils, filters, valves, air vents, control devices, traps, cleanouts and other similar devices requiring periodic observation adjustment, service or replacement.
- N. Exact location of each access door shall be determined prior to installation and such information shall be submitted to University's Representative for review and approval. Ceiling access doors shall be no less than 24" x 24" and wall access doors shall be sized to suit equipment, but not less than 12" x 12".

3.02 TESTING FOUR-INCH PRESSURE CLASS DUCTWORK AND PLENUMS

- A. Contractor to test all pressure ductwork and plenums for leaks using a portable high-pressure blower and necessary instrument. Extreme care shall be used in fabrication and installation of ductwork to ensure that it will be airtight. All ductwork shall be tested for leaks in sections as work progresses and as directed by University's Representative. Section to be tested shall have all open ends sealed off and shall then be tested using the following method:
 - 1. Orifice Flow Test: Equipment required for this testing comprises a high-pressure blower, orifice test pipe assembly, and manometer with necessary valves and tubing. All testing shall be in conformance with SMACNA "HVAC Air Duct Leakage Test Manual," latest edition. Ductwork section being tested shall be held under a constant pressure of 4" of water with blower while any leakage flow through orifice is measured on manometer. Manometer readings shall be converted to CFM from a calibrated test curve. Leakage shall not exceed one percent of design air flow with a maximum allowable of 500 CFM. Complete information and data on equipment to be used must be submitted to University's Representative for approval before any tests are made.

- B. Testing of any completed section of ductwork must be made before installation of finished ceiling, if any, or before ductwork is furred in inaccessible spaces and must be witnessed by University's Representative. Any leaks found must be properly repaired or joints remade, and section re-tested until tight. Leaks which cause any objectionable noise must be repaired, regardless of amount of leakage.
- C. Upon completion of testing, the Contractor shall complete the test report forms provided by SMACNA "HVAC Air Duct Leakage Test Manual." These forms shall be made in triplicate and forwarded to the University's Representative for review.

3.03 CLEANING AND PROTECTION

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.
- B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

3.04 OPERATION TEST

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.05 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, and tools, and leave premises clean, neat, and orderly.
- B. Ductwork: Examine air-handling systems and clean any obstruction and debris. With dampers wide open and closed, run fan systems and check for air leaks.
- C. All distribution equipment shall not be operated until the building is cleaned.

END OF SECTION 158900





SECTION 159900
PLUMBING/HVAC FINAL TESTING, ADJUSTING AND BALANCING

PART I - GENERAL

1.01 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. Fans
 - 2. Ductwork systems
 - 3. Piping systems
 - 4. Terminal units
 - 5. Balance Valves for Plumbing systems

1.02 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.

1.03 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 Adobe 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.

1.04 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 II - PRODUCTS

2.01 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.

2.02 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 III - EXECUTION

3.01 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. Supply, Return, and Exhaust Fans: Cubic feet per minute, static pressure, and outlet velocity.
3. Coils: Gallons per minute, fluid temperature, and air temperature at outlet and inlet.
4. Terminal Air Distribution Units: Cubic feet per minute and inlet static pressure.
5. Inlets, Outlets, and Main Branch Ducts: Air velocity and cubic feet per minute.
6. All Rooms: Air temperature during test.
7. Other information required to establish completely balanced systems.

3.02 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.

END OF SECTION 159900



SECTION 15990
PLUMBING/HVAC FINAL TESTING, ADJUSTING AND BALANCING

PART I - GENERAL

1.01 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. Fans
 - 2. Ductwork systems
 - 3. Piping systems
 - 4. Terminal units
 - 5. Balance Valves for Plumbing systems

1.02 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.

1.03 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 Adobe 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.

1.04 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 II - PRODUCTS

2.01 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.

2.02 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 III - EXECUTION

3.01 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. Supply, Return, and Exhaust Fans: Cubic feet per minute, static pressure, and outlet velocity.
3. Coils: Gallons per minute, fluid temperature, and air temperature at outlet and inlet.
4. Terminal Air Distribution Units: Cubic feet per minute and inlet static pressure.
5. Inlets, Outlets, and Main Branch Ducts: Air velocity and cubic feet per minute.
6. All Rooms: Air temperature during test.
7. Other information required to establish completely balanced systems.

3.02 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.

END OF SECTION 15990



**SECTION 159100
DUCT ACCESSORIES**

PART I - GENERAL

1.01 WORK INCLUDED

A. Types of ductwork accessories required for this project include the following:

1. Turning Vanes
2. Duct Hardware
3. Duct Access Doors
4. Flexible Connections
5. Dampers
6. Fire Dampers
7. Fire/Smoke Dampers
8. Air Outlets and Inlets
9. Constant Volume Boxes

1.02 QUALITY ASSURANCE

- A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible), latest edition, for all work in this section.
- B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) recommendations, latest edition, for all work in this section.
- C. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- D. UL Compliance: Construct, test, install and label fire dampers, smoke dampers, combination fire smoke dampers, and fire doors, in accordance with Underwriters Laboratories (UL) Standard 555 and 555S, "Fire Dampers and Ceiling Dampers," latest edition.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data in accordance with requirements of Specification Section 013300. Submit manufacturer's product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

- B. Equipment Data and Operation and Maintenance Instructions: Submit in accordance with Specification Sections 017800 and 150100 requirements.

PART II - PRODUCTS

2.01 TURNING VANES

- A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards," latest edition. Vanes to be high efficiency profile of minimum 26 gauge hot-dipped galvanized steel. Side rails minimum 24 gauge hot-dipped galvanized steel.
- B. Manufacturers: Aero Dyne HEP, Duro-Dyne Corporation, or equal.

2.02 DUCT HARDWARE

- A. Provide duct hardware manufactured by one manufacturer for all items on project for the following:
 - 1. Test Holes: Provide in ductwork at fan inlet and outlet and elsewhere as required for duct test holes consisting of slot and cover for instrument tests.
 - 2. Quadrant Locks: Provide for each damper quadrant lock device on one end of shaft and end-bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and extended bearing plates for externally insulated ductwork.
- B. Manufacturers: Ventfabrics, Inc., Young Regulator Company, or equal.

2.03 DUCT ACCESS DOORS

- A. Provide airtight access doors in ducts and plenums for cleaning and repairs for volume and fire dampers for control devices within such ductwork and where shown on the Drawings.
- B. Access doors into 2" pressure class ductwork shall be made of No. 24 gauge galvanized steel minimum, reinforced with angle iron stiffeners. Doors shall be hinged and provided with latches and gasket around entire edge to provide an airtight fit. Reinforce openings for doors with structural steel.
- C. Access doors into ductwork greater than 2" pressure class shall be made of No. 22 gauge galvanized steel, removable double skin. Doors 16" and under to have two (2) locks. Doors over 16" to have four (4) locks.
- D. Exact location of each access door shall be determined prior to installation and such information shall be submitted to University's Representative for review and approval.
- E. Provide access doors at each change in direction requiring turning vanes, at bottom of risers, and every 50' in horizontal runs.
- F. Manufacturers: Ruskin, Ductmate, Nailor or equal.

- G. Coordinate ceiling and wall access door locations with Architectural. Access doors shall be sized to suit equipment. Access doors in inaccessible ceilings and walls are required to gain access to all dampers, terminal units, coils, filters, valves, air vents, control devices, traps, cleanouts and other similar devices requiring periodic observation adjustment, service or replacement.

2.04 FLEXIBLE CONNECTIONS

- A. Furnish and install flexible connections at following locations:
 - 1. Exhaust
 - 2. Duct connection of return fan
 - 3. Duct connection of exhaust fan
 - 4. Elsewhere as shown on Drawings
- B. Flexible connections shall be preassembled flexible connectors constructed of coated glass fabric applied in accordance with manufacturer's recommendations. Width of flexible connections shall be sufficient to allow minimum of 2" of free space between two metal collars to be connected. Install sheet metal band completely around duct or fan outlet, at end of flexible connection. Fasten with metal screws through band and coated glass fabric. Space screws approximately 3" apart. Coated glass fabric shall be Ventfabrics Ventglas with neoprene coating for use inside building, or equal, and Ventlon with hypalon coating, or equal, when exposed to weather.
- C. Manufacturers: Ventfabrics, Inc., Duro-Dyne Corporation, or equal.

2.05 DAMPERS

- A. Manual Dampers: Provide dampers of single-blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," latest edition. Damper blades shall not exceed 6" in width, except that 8" wide damper may be used in 8" wide ducts.
 - 1. Where dampers are installed above non-accessible ceilings, and are not served by access doors, provide extension rods and concealed ceiling mounted damper regulators. Regulator shall be equal to Ventlok Model 666.
 - 2. Balancing dampers shall be installed in all branch ducts and elsewhere as indicated on the drawings.
- B. Control Dampers: Refer to Division 15 Section "Temperature Control Systems" for control dampers, not work of this section.
- C. Backdraft Dampers: Provide dampers with parallel blades, constructed of 16-ga. aluminum; provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" by 1/2" by 1/8" steel channel for face areas 25 sq. ft. and under; 4" by 1-1/4" by 16-ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

- D. Smoke Control Dampers: Provide and install at locations shown on drawings. Each smoke damper shall be classified as a UL555S Leakage Class 1 smoke damper. Smoke dampers shall have the capacity to operate (to open and close) under HVAC system operating conditions, with pressure up to 4" w.g. in closed position, and 2,000 fpm air velocity in open position. Damper and actuator shall be supplied as a complete assembly. Damper assembly shall be Ruskin Model SD37 or equal.
- E. Submit complete installation instructions for all types of damper to be used on this project, as part of main submittal.
- F. Manufacturers: Ruskin Manufacturing Company, American Warming and Ventilating, Inc., Arrow Louver and Damper Corporation, or equal.

2.06 FIRE DAMPERS

- A. Fire Dampers: Fire dampers shall be of folding-curtain type conforming to NFPA 90A and Underwriters Laboratories (UL) Standard 555 and 555S, "Fire Dampers and Ceiling Dampers," current edition, and the State Fire Marshall. Dampers shall be arranged to close automatically upon operation of listed fusible link and shall be held tightly closed by means of steel spring clip latch. Fusible links shall have temperature rating approximately 50°F. above normal maximum operating temperature. Steel parts shall be factory galvanized.
 - 1. Dampers shall be factory installed in integral sleeves.
 - 2. Sleeves shall be supported by mounting flanges.
- B. Dampers shall be equal to the following Ruskin Manufacturing Company dampers:
 - 1. Vertical mounted: IBD or DIBD as appropriate for the fire rating and systems conditions.
 - 2. Ceiling mounted: CFD and CFDR as appropriate for the fire rating and system conditions.

2.07 COMBINATION FIRE/SMOKE DAMPERS

- A. Fire/smoke dampers shall be furnished and installed at locations shown on plans or as described in the schedules. Dampers shall meet the requirements of NFPA90A, 92A and 92B and shall be classified for use for fire resistance ratings as indicated on the plans in accordance with UL555. Dampers shall further be classified as Leakage Rated Dampers for use in smoke control systems in accordance with the latest version of UL555S. The leakage rating under UL555S shall be leakage class 1.
- B. Each combination fire/smoke damper shall be equipped with a "controlled closure" quick detect heat-actuated release device. Fusible Link: Replaceable, 165°F. Provide 212°F rated as required.
- C. Damper frame shall be a minimum 16 gage galvanized steel formed into structural hat channel reinforced at corners.
- D. Roll-Formed Steel Blades: Interlocking 16-gauge galvanized steel, 5" minimum, 8" maximum single blade width. Stiffen damper blades to provide stability under operating conditions.

- E. Blade and Jamb Seals: Flexible stainless steel compression type jamb seals. Silicone coated fiberglass fabric blade seals mechanically locked into blade edge.
- F. Linkages: External only.
- G. Blade Axles: Galvanized steel. Extend axles full length of damper blades.
- H. Bearings: Stainless steel sleeve, pressed into frame.
- I. Mounting Sleeve: Factory-supplied caulked sleeve, minimum of 20-gauge galvanized steel, length to suit wall or floor application.
- J. Damper Actuators: Provide a damper actuator factory-installed out of the air stream on the factory sleeve. Damper actuators will meet requirements of UL 555S for application on a smoke damper, and will be rated for operation at an elevated temperature of 250°F.
 - 1. Damper actuators will be electric (120VAC) 2-position, spring return that closes damper upon loss of power. The switching relay to operate damper actuators from a fire alarm signal will be provided by under Division 16. Coordinate power and signal requirements with Division 16.
 - 2. Damper actuators will be pneumatic 2-position which closes damper upon loss of control air signal. Provide electric-pneumatic switches to operate damper actuators from a fire alarm signal. Coordinate control air requirements with Division 15 Section "Automatic Control System." Coordinate power and signal requirements with Division 16.
- K. Damper End Switches: Factory-supplied switch packages to remotely indicate damper blade position. Coordinate power and signal requirements with Division 16. End switches shall be separate device, not a combination damper motor/end switch.
- L. Dampers shall be equal to the following Ruskin, Inc.
 - 1. FSD60 or FSD37 as appropriate for the fire rating and systems conditions with FSNF120 (-S) BELIMO actuator.

2.08 AIR OUTLETS AND INLETS

- A. Grilles, registers, and diffusers shall be selected and guaranteed to operate without objectionable noise or draft.
- B. Furnish and install sponge rubber gaskets between grilles and grounds of finished surfaces. Wood grounds will be furnished by others. Metal grounds shall be furnished by this Contractor. Sidewall grilles and registers shall be provided with dull prime coat finish, unless noted otherwise. All supply diffusers, registers, and grilles located at ceiling shall have factory-applied, bone-white finish.
- C. Paint visible ductwork behind grilles, registers, and diffusers dull black.

D. Outlet/Inlet

1. Ceiling Diffuser

- a. Titus Model MCD (with OBD where indicated on schedule) and throw reducing vanes, or equal. Provide frame style 1 for gypboard ceiling. Provide full 24 X 24 ceiling plates at T-bar ceilings, with frame style 3 to suit T-bar style.

2. Supply Register

- a. Titus Model 272 RL (Wall) airfoil blade (with OBD where indicated on schedule), or equal.

3. Continuous Linear

- a. Titus Model MPI, or equal.

4. Supply/Return

- a. Linear supply diffuser with Border Type 2A and Model MLR Linear Return with Border Type 9A, or equal. Provide Supply/Return mitered end caps, (linear) alignment strips, insulated supply plenums, slot width and number of slots as noted on Drawings.

5. Exhaust/Return

- a. Titus Model 30RL Registers (with OBD where indicated on schedule), or equal, no known equal. Provide full 24 X 24 ceiling plates at T-Bar ceilings, with frame style to suit T-Bar style.

6. Extractor

- a. Titus Model AG-45 with gear operator, or equal.

- E. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown of size, shape, capacity, and type indicated; constructed of materials and components as indicated and as required for complete installation. Provide diffusers with border styles that are compatible with adjacent ceiling systems and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

- F. Manufacturers: Titus, Krueger, or equal.

2.09 CONSTANT VOLUME BOXES

- A. Furnish and install single duct, variable volume terminals of the sizes and capacities noted on the Drawings.
- B. The terminals shall have pressure independent digital controls and shall be reset for airflow between zero and maximum cataloged cfm. Airflow limiters will not be accepted.

- C. NC levels to be less than or equal to scheduled levels. Furnish sound data for both casing radiated and discharge sound levels for second through seventh octave bands as tested in accordance with ADC standards.
- D. Static pressure drop shall not exceed scheduled values.
- E. Terminals must be certified under the ARI Standard 880-89 Certification Program and carry the ARI seal. If the contractor wishes to submit a terminal which is not certified with ARI, the terminal must be tested at an independent testing laboratory under conditions selected by the University's Representative in full compliance with the testing methods defined by ARI Standard 880-89. Tests shall be witnessed by the University's Representative with all costs and expenses borne by the contractor. Testing does not ensure acceptance.
- F. The terminal shall contain a multi-point, center averaging, amplifying velocity sensor. The measuring ports must be parallel to the take-off from the sensor.
- G. All pneumatic tubing shall be UL listed, fire retardant (FR) type and of type specified in Section 159600, BACS.
- H. The digital controller shall be factory mounted in a metal panel attached to the side of each terminal box.
- I. The terminal casing shall not be less than 22 gauge galvanized steel with Fibre-Free lining (Steri-Loc for OSHPD applications), no fiberglass internal lining. The casing shall be sealed to hold leakage to 1% at 1-1/2" w.g.
- J. The damper shall be heavy gauge metal, with its shaft rotating in Delrin self-lubricating bearings. The shaft shall be marked on the end to indicate the damper blade position. The terminal shall be designed for field conversion from normally closed to normally open.
- K. The damper shall have a built-in stop to prevent over stroking and shall seal against a closed-cell foam gasket, to limit close-off leakage to the maximum of 2% at 6" w.g.
- L. Units to be equipped with integral attenuator and hot water coil where specified. Manufacturers: Titus, Krueger, or equal.

2.10 DUCTWORK IDENTIFICATION

- A. Ductwork identification shall consist of stencil-painted identification on ductwork housing of the air handling systems; including arrows to show flow, systems numbers and generic name of service. Mark primary runs at housing and main branches, and mark access doors to indicate equipment in housing or duct. Mark ductwork at 20' intervals. Where concealed behind removable ceilings, markings may be plasticized tags in lieu of stencil-painted markers.
 - 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 for identification for plumbing shall be blue/HVAC-yellow/Electrical-green/Fire-red.

PART III - EXECUTION

3.01 INSTALLATION OF DUCT ACCESSORIES

- A. Install duct accessories in accordance with manufacturer's installation instructions with applicable portions of details of construction as shown in SMACNA standards and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90° elbows in supply and exhaust air systems and elsewhere as indicated.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work as necessary to interface installation of duct accessories properly with other work.
- E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leak proof performance.

3.02 INSTALLATION OF AIR OUTLETS AND INLETS

- A. Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.
- B. Locate ceiling air diffusers, registers, and grilles as indicated on general construction "Reflected Ceiling Plans." Unless otherwise indicated, locate units in center of acoustical ceiling modules.
- C. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- D. Ceiling-mounted air terminals or services shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Terminals or services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Terminals or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

3.03 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 installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.04 INSPECTION OF FIRE DAMPERS

- A. Fire/Damper and Smoke/Damper annular space shall be inspected prior to angles being installed. All fire dampers shall be tested by the contractor and again in the presence of the University Fire Department and the California State Fire Marshal. Provide spare fusible links as required to complete testing to the complete satisfaction of the local fire department.

3.05 OPERATION TEST

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.
 - 1. Any leaks found must be properly repaired, or joints remade and the section retested until tight. Any leaks which cause an objectionable noise in excess of 40 db must be repaired, regardless of the amount of the leakage. Any diffuser installation which causes an objectionable noise in excess of specified below must be corrected: Patient Rooms - 35 db; Office and Exam rooms - 40 db; Corridors and Waiting Rooms - 40 db.
 - 2. The leakage shall not exceed 1% of the designed flow, with a maximum allowable in any case, of 50 CFM. No less than 50' of duct measured along the main shall be tested at one time. All branches shall be tested at same time as the main.

3.06 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 159100



SECTION 26 05 00

ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 019113 – Commissioning
- B. 011813 – Sustainable Design Requirements

1.2 WORK INCLUDED

- A. Furnish and install all necessary labor, materials, tools and equipment to perform and completely finish the work according to the intent of this specification, and the accompanying drawings.
- B. Provide conduit, wires and other miscellaneous materials, equipment and devices, not specifically mentioned in other sections of Division 26, but necessary and/or required for equipment or system operation of function.
- C. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service. Refer to Section 260519 of these specifications for connection requirements.
- D. Drawings indicate design loads and voltages and corresponding control equipment, feeders, and overcurrent devices. If equipment actually furnished, other than for equipment provided by the University, have loads or voltages other than those indicated on the drawings or specified herein, control equipment, feeders, and overcurrent devices shall be adjusted in size accordingly at no additional cost to the University. Such adjustment shall be subject to the review of the University's Representative.
- E. Provide connections of all equipment specified under this section and any other section and Division 22 and 23 including installation and connection of all relays, remote starters, etc. and the connection of all motors and controllers. Control wiring for Division 22 and 23 systems shall be provided by Division 23. Review Division 23 specifications and shop drawings for control

systems to assure compatibility between equipment furnished under Division 26 and wiring furnished under Division 22 and 23. Motor controllers (starters) shall be furnished and installed under Division 26, unless specified to be furnished as an integral component of the equipment or unless controller is variable frequency drive type. Provide the number and type of auxiliary contacts necessary to interlock the equipment and provide the control sequence in Division 22 and 23.

1.3 LOCAL CONDITIONS

- A. Examine site; verify dimensions and locations against drawings and become informed of all conditions under which work is to be done before submitting proposal. No allowance will be made for extra expenses because of omission on Contractor's part to include cost of work under prevailing conditions.
- B. Information shown relative to services is based upon available records and data shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made without extra cost.
- C. Extreme care shall be exercised in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations.
- D. Request any utility shutdown, dig permit or road closure through the University's Representative, 14 days in advance. Include detailed procedure and proposed schedule. In each case approval must be obtained from the University's Representative for the requested shutdown time and work involved. Shutdown work shall be performed on overtime hours if so directed by the University.
- E. Protect premise and work of other trades from damage arising out of installation of work of this division. If damage has occurred, repair or replace materials and parts of premises as directed by University's Representative at no cost to the University.

1.4 CODES AND STANDARDS

- A. Applicable codes are those specified in Section 01 41 00 – Regulatory Requirements. Nothing in the Drawings or Specifications shall be construed to permit work not conforming to these codes, latest edition as adopted by authority having jurisdiction.
- B. Material Standards: All material shall be new and shall conform to the standards where such have been established for the particular material in question. Publications and Standards of the organization listed are applicable to materials specified herein. Also refer to Division of these specifications: Insulated Cable Engineers Association (ICEA), Institute of Electrical and Electronic Engineers (IEEE), Edison Electric Institute (EEI), American Wood Preservers

Association (AWPA), National Board of Fire Underwriters (NBFU), Illuminating Engineering Society (IES), Electrical Testing Laboratory (ETL).

- C. Code compliance is mandatory - no information or details on the drawings or specifications permits work not conforming to code. Where work is shown to exceed minimum code requirements perform work per drawings and specifications.

1.5 DRAWINGS

- A. The drawings indicate the arrangements of electrical equipment. Review architectural drawings and details for door swings, cabinets, counters and built-in equipment; conditions indicated on architectural plans shall govern. Coordinate installation of electrical equipment with structural system and mechanical equipment and access thereto. Coordinate installation of recessed electrical equipment with concealed ductwork and piping, and wall thickness.
- B. Do not scale drawings. Obtain dimensions for layout of equipment from Architectural plans and details unless indicated on Electrical plans. Field measurements take precedence over dimensioned drawings.
- C. Bring all discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions to the immediate attention of the University's Representative.
- D. Equipment layout is based on one manufacturer's product or from composite dimensions from multiple manufacturers. Where equipment selected for use on the job differs from layout, coordinate space requirements and connection arrangements with Engineer. Equipment which exceeds specified maximum dimensions or which reduces required clearances shall not be accepted.

1.6 RECORD DRAWINGS

- A. Upon completion of all Work, but before final acceptance, the Contractor shall furnish the University's Representative with complete sets of reproducible drawings updated and corrected to "as-built" conditions as specified. The contract documents drawings issued for bid shall be revised for "as-built" conditions. Include electronic panelboard files in Excel format updated to "as-built" conditions, copies of all submittal data, shop drawings, control Panel layout, point to point wiring diagram, conduit routing, underground duct banks, site lighting and any other detailed drawings.
- B. All symbols, designations, and layers used in preparing Record Drawing shall match those used in Contract Drawings and electronic files.

- C. Show all buried and concealed conduit, stub-outs, etc. Locate all buried conduit and stub-outs by dimensions from permanent, easily located and identifiable portions of structure; also, dimension ends of stub-outs, etc. Note depth of buried items below grade.

1.7 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit for review by the University's Representative data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable. Provide complete electrical characteristics for all equipment. Submittals for lighting fixtures shall include Photometric data.
2. Refer to the individual sections for identified equipment and materials for which submittals are required.
3. Refer to Division 1 for required procedures.

B. Operation and Maintenance Data and Instruction:

1. Refer to Division 1 for detail requirements.
2. Printed Material: Provide required printed material for binding in operation and maintenance manuals.
3. Instructions of University Personnel:
 - a. Before final inspection, as designated by the University's Representative provide a competent representative to instruct University's designated personnel in systems under this division of the specifications. For equipment requiring seasonal operation, perform instructions for other season within six months unless requested otherwise.
 - b. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
 - c. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials mentioned herein or on drawings require that each item listed be provided and of quality noted, or an approved equal. All material shall be new, full weight and standard in all respects and in first-class conditions. Materials and equipment shall be uniform throughout the installation. Where possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.
- B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein. Substitutions will be also be evaluated on maintenance track record and parts availability for previous installations that have been installed a minimum of five years. Refer to Specification Section 01 33 23. Dimensions, sizes and capacities shown are a minimum and shall not be changed without permission of Engineer.
- C. All electrical equipment and materials shall satisfy minimum requirements of NEMA, IEEE and ANSI standards. All materials must be UL approved, or if not covered by UL testing standards, shall be test and approved by a Nationally Recognized Testing Laboratory (NRTL).
- D. Work such as painting, patching, welding or carpentry related to the work of this Division shall be performed by the appropriate trade experienced in that work, but shall be provided for under this Division.
- E. The following systems will be purchased and installed separately by the University. Provide all the conduit and outlet boxes required for complete installation under this contract. Provide input to and coordination with the University's Representative during the preparation of the shop drawings. Review shop drawings provided by University's Representative for installation information and provide comments as required. Installation of conduit and outlet boxes shall be governed by shop drawing requirements. All special system conductors will be provided and installed by the contractor; all conductors required for 120-volt power shall be provided under this contract. Notify the University's Representative of required dates for shop drawing completion and material delivery to coordinate with overall construction schedule. Specification sections contained herein are based on a complete system - individual components to be provided by the University are not identified other than by the requirements of this paragraph.
 - 1. Security Cameras and camera mounts.

PART 3 - EXECUTION

3.1 ELECTRICAL SYSTEMS OPERATIONAL TESTS, MANUFACTURERS SYSTEMS CERTIFICATION AND DESIGN AUTHORITY ASSISTANCE

- A. Commissioning The project will have selected building systems commissioned. The equipment and systems to be commissioned are specified in Section 01 91 13. The commissioning process is described in Section 01 91 13.

3.2 GENERAL

- A. All electricians to be state certified and apprentices in an approved training program.
- B. When changes in location of any work are required, obtain approval of University's Representative before making changes.
 - 1. Make changes at no extra cost.
- C. Do not change indicated sizes without written approval of University's Representative.
- D. Provide all necessary offsets and crossovers in conduits, raceways, cabletrays and ducts.
- E. Provide flexible connections of short length to installations or equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor across all flexible connections.
- F. Install exposed conduits parallel to walls and ceilings and vertically plumb, unless otherwise indicated.
- G. Existing equipment or electrical wiring which is to remain, but has been removed to facilitate the installation of the new equipment, shall be restored to its original operating condition.
- H. Where electrical items penetrate fire or smoke rated walls, ceilings and floors, comply with Section Division 7.
- I. Before any cutting, burning, heating or other work that will emit smoke, dust or other products of combustion that may set off the fire alarm system, request a fire alarm system shutdown from the University's inspector. This request shall be made at least 14 days prior to the date the shutdown is required. If this requirement is ignored and triggers the fire alarm system the offending party shall be responsible for all false alarm charges from the fire department. Instruct all personnel of this requirement before they are permitted on the job site. If the job site has a portable fire alarm system installed for the construction period, turn the system on and off each working day.
- J. Provide concrete foundations or pads as follows for floor mounted electrical equipment where indicated on the drawings:

1. Install minimum 4" high concrete pads or as indicated. Other pad dimensions shall be as required to accommodate the equipment installed.
2. Use 3,000 PSI (14 Kg/s/mm) concrete.
3. Reinforce with 6" x 6" W2.9 x W2.9, 10GA (3.4mm) mesh, with short dowels into floor at 12" OC around perimeter.
4. Chamfer top edges $\frac{3}{4}$ " (18mm).
5. Make all faces smooth.
6. Set anchor bolts for equipment. Consult with user.
7. Coordinate the size of all pads, the location of all anchor bolts, and the location of all vibration isolators.

3.3 QUALITY ASSURANCE AND PROJECT SAFETY

- A. Provide quality assurance and project safety programs. Satisfy the minimum acceptable requirements provided in the specifications.

3.4 PREPARATION

- A. Examine Drawings and Site; be familiar with types of construction where electrical installation is involved.
 1. Work shall be neatly installed in a professional manner in accordance with NECA Standard of Installation. Work shall be coordinated with other trades to avoid conflicts. Clarifications will be made by University's Representative and minor adjustments shall be made without additional cost to University. Obtain clarification from University's Representative concerning any obvious discrepancies or omissions in work before bidding. All work involved in correcting obvious errors or omissions after award of Contract shall be performed as directed by University's Representative without additional cost to University.
- B. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial), but shall be followed as closely as possible. Drawings and Specifications are for assistance and guidance, and exact locations, distances, levels, etc., will be governed by Site.
- C. Schedule of Values:
 1. Refer to Division 1 for submittal requirements.

2. Provide a schedule of values for the electrical work specified under Division 26. Include separate labor and material itemization for each line item requested. The itemized schedule of values will be used to determine project completion and progress for payment requests, including overhead and profit for each itemization. Schedule of values must be submitted and approved prior to first pay request. Provide the following line items as a minimum level of itemization:
 - a. Electrical service and distribution (include all power equipment, i.e., panelboards, transformers, feeders, motor controllers, etc.).
 - b. Lighting systems (include all fixtures, lamps, branch circuiting, and lighting controls).
 - c. Devices (include all power outlets and branch circuit wiring not associated with lighting, motors, or equipment connections).
 - d. Equipment connections (include all wiring and connection to HVAC, elevators, etc., including controlling devices and feeders).
 - e. Basic work and materials (include work common to all systems, i.e., backboards, cutting and patching, demolition, temporary services, record drawings, permits, etc.).
 - f. Special systems (itemize separately, including emergency power supply system, grounding system, UPS equipment, etc.).
 - g. Communications/signaling systems (include all low voltage systems, itemized separately, i.e., fire alarm, sound paging, security, etc.).

3.5 WORKING SPACE

- A. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders. In general, provide 36" minimum clear workspace in front of panelboards and controls.
 1. 36" @ 250V and less.
 2. 42" @ 250V to 600V.

3.6 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material including University furnished material. Handle materials in accordance with manufacturer's applicable standards and suppliers recommendations, and in a manner to prevent damage to materials. Store packed materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are

broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises and replaced at no additional cost to the University.

- B. All material, except items specifically designed to be installed outdoors, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided. Provide temperature and humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weathertight structure. Equipment stored other than as specified above shall be removed from the premises and replaced at no additional cost to the University.
- C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced at no additional cost to the University.

3.7 CARE AND CLEANING

- A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trim, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.
- B. Accessible elements of disconnecting and protective devices of equipment, coils of dry type transformers and the like shall be cleaned with compressed air (less than 15 PSI) and the enclosures vacuum cleaned prior to being energized.
- C. Clean light fixtures and lamps thoroughly, just prior to final inspection. Fixture enclosures, shielding, etc., shall be cleaned by an approved method.
- D. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinets unless required by the University's Representative. Remove trim covers before painting. Under no conditions shall locks or exposed trim clamps be painted.
- E. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.
- F. Where plywood backboards are used to mount electrical equipment provided under Division 26, paint backboards with two coats of light gray semi-gloss fire retardant paint under Division 26.

- G. Plywood, Mounting Backboard for Communications Equipment - Plywood mounting backboard shall extend ceiling-to-floor (10'), unless otherwise specified. Mount plywood to cover the entire area on which connecting hardware and cable management hardware may be mounted. Mounting board shall be AC-grade or better, void-free plywood, with a minimum thickness of 19 mm ($\frac{3}{4}$ ").
1. Two-coats of FR-S fire-retardant rated paint shall be applied to all exposed surfaces. The plywood-rating stamp shall be left exposed for inspection purposes.
 2. Securely fasten plywood to wall-framing members. Use flush hardware and supports to mount plywood.
 3. Ensure that the strength and placement of the hardware are sufficient to handle the total anticipated load (static and dynamic) and mounting of cabling components.
 4. Color of paint shall be **WHITE**.
- A. All broken, damaged or otherwise defective parts shall be repaired or replaced without additional cost to the University. Work shall be left in a condition satisfactory to University's Representative. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work. Systems and equipment shall be left in a satisfactory operating condition.
- B. All surplus materials and debris resulting from this work shall be periodically cleaned out and removed from site; this includes surplus excavated material.

3.8 EXCAVATING AND BACKFILLING

- A. Excavate and backfill as required for installation of electrical work. Restore all surfaces, roadways, sod, walks, curbs, walls, existing underground installation, etc., cut by installations to original condition in an acceptable manner. Maintain all warning signs, barricades, flares and lanterns as required by the Safety Orders and local ordinances.
- B. Excavation: Dig trenches straight and true to line and grade, with bottom clear of any rock points. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of crown shall be 2' below finished grade.
- C. Backfill: All backfill material shall be local material free of rubble, rubbish or vegetation. Trenches shall be backfilled and compacted to 90% of maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3.9 CUTTING AND PATCHING

- A. Provide necessary cutting and patching required to accomplish the work of Division 26.
- B. Do not endanger the stability of the structure by cutting, drilling or otherwise modifying the structural members of the building. Direct all requests for structural modifications to the University's Representative for approval. Proceed with these modifications only as directed by the University's Representative.
- C. Cutting and patching requirements will be modified only if General Construction Specifications and drawings specifically state that certain portions or all cutting and patching required for each of the various trades is to be performed.
- D. Refer to General Construction Specifications for execution and requirements for patching and painting and comply with applicable provisions as to materials and quality of installation.

3.10 PROTECTION

- A. In performance of work, protect work from damage. Protect electrical equipment, stored and installed, from dust, water or other damage.

3.11 EQUIPMENT IDENTIFICATION

- A. Panelboards, remote control switches, terminal boxes, etc., shall be properly identified according to section 260553 of these specifications.

3.12 RUST INHIBITER

- A. Channels, joiners, hangers, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of one hundred twenty (120) hours when subjected to a standard salt spray cabinet test, or shall be hot dipped galvanized.

3.13 ELECTRICAL SYSTEMS OPERATIONAL TESTS, MANUFACTURERS SYSTEMS CERTIFICATION AND DESIGN AUTHORITY ASSISTANCE

- A. Testing:
 - 1. Provide tests specified in other sections. Test all wiring and connections for continuity and grounds; where such test indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.

2. Refer to the individual specification sections and Section 26 90 90 of the specifications for test requirements.
3. Prior to the final inspection, the systems or equipment shall be tested and reported as therein specified. Five (5) typewritten copies of the tests shall be submitted to the University's Representative for approval. Testing does not replace the requirement for final inspection of the project work.
4. All electrical systems shall be tested for compliance with the specifications.

B. Manufacturers Certifications:

1. The electrical systems specified herein shall be reviewed for compliance with these specifications, installation in accordance with the manufacturers' recommendations and system operation by a representative of the manufacturer. The manufacturer shall submit certification that the system has been reviewed by the manufacturer, is installed in accordance with the manufacturer's recommendations and is operating in accordance with the specifications.
2. Provide manufacturers certification for the following systems:
 - a. Fire Alarm System
 - b. Clock System
 - c. Security Systems
 - d. Intercom System
 - e. Public Address System
 - f. Lighting Control Systems
 - g. Automatic transfer switches
3. Design Authority Assistance:
 - a. Remove equipment covers (i.e. panelboard trims, motor controls, device plates, and junction box covers) as directed for inspection of internal wiring. Accessible ceilings shall be removed as directed for inspection of equipment installed above ceilings.
 - b. Energize and de-energize circuits and equipment as directed. Demonstrate operation of equipment and systems as directed by the University's Representative.
 - c. Provide authorized representatives of the manufacturers to demonstrate to the University's Representative compliance with the specifications of their respective system during or prior to the final inspection at a time designated by the University's Representative. Refer to the specific specification section for additional testing

requirements. Representatives of the following systems are required for demonstrations:

- 1) Fire Alarm System
- 2) Intercom System
- 3) Surveillance System
- 4) Public Address System
- 5) Lighting Control System
- 6) Automatic Transfer Switches

3.14 CLOSING OF AN UNINSPECTED WORK

- A. Do not allow or cause any of work installed hereunder to be covered up or enclosed before it has been inspected and approved.
- B. Should any work be enclosed or covered up before it has been approved, uncover such work and after it has been inspected and approved, make all repairs necessary to restore work of others to conditions in which it was found at time of cutting, all without additional cost to the University.

3.15 TEMPORARY FACILITIES

- A. Provide temporary shop office and storage space on site only at locations approved by the University's Representative. Remove these facilities upon completion of work.

3.16 NOISE AND VIBRATION

- A. Cooperate in reducing objectionable noise or vibration. If noise or vibration occurs as a result of the use of improper material or installation, correct these conditions at no cost to the University.

END OF SECTION 26 05 00

SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

GENERAL

1.1 DESCRIPTION

- A. The work required under this section of the specifications consists of furnishing, installing and connecting the building wiring system, 600 volts and below. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. Wiring systems for communication and alarm systems are not included in this section unless specified to be included, by reference, in the respective specification sections for alarm and communication systems.

1.2 RELATED WORK

- A. Section 260533 – Raceways
- B. Section 260520 – Electrical Connections for Equipment

1.3 QUALITY ASSURANCE

- A. Industry Reference Standards. The following specifications and standards are incorporated into and become a part of this Specification by Reference.
 - 1. Underwriters' Laboratories, Inc. (UL) Publications:
 - a. No. 83 Thermoplastic - Insulated Wires
 - b. No. 486 Wire Connectors and Soldering Lugs
 - c. No. 493 Thermoplastic - Insulated Underground Feeder and Branch Circuit Cables
 - d. No. 854 Service Entrance Cables
 - 2. Insulated Cable Engineers Association Standards (ICEA):
 - a. S-61-402 Thermoplastic Insulated Wire and Cable
 - 3. National Electrical Manufacturer's Standards (NEMA):

- a. WC-5 Thermoplastic Insulated Wire and Cable
 - b. WC-26 Wire and Cable Packaging
 - 4. UBC Standard 4-1 for non-combustible materials for wires and cables above non-sprinklered ceilings.
- B. Acceptable Manufacturers: Products produced by the following manufacturers which conform to this specification are acceptable.
- 1. Hydraulically applied conductor terminations:
 - a. Scotch (3M)
 - b. Thomas and Betts (T&B)
 - c. or equal
 - 2. Mechanically applied (crimp) conductor terminations:
 - a. Scotch (3M)
 - b. Thomas and Betts (T&B)
 - c. or equal
 - 3. Vinyl electrical insulating tape:
 - a. Scotch (3M)
 - b. Tomic
 - c. or equal
 - 4. Twist-On Wire Connectors:
 - a. Buchanan
 - b. Ideal
 - c. or equal
 - 5. Encapsulated insulating kits:
 - a. Essex Group, Inc.
 - b. Raychem
 - c. Scotch (3M)
 - d. or equal

6. Portable cable fittings:

- a. Crouse Hinds
- b. T & B
- c. or equal

7. Insulated cable:

- a. Pirelli Cable Corp.
- b. Southwire Co.
- c. or equal

- C. Performance: Conductors shall be electrically continuous and free from short circuits or grounds. All open, shorted or grounded conductors and any other damaged insulation shall be removed and replaced with new material free from defects.
- D. Delivery, Storage and Handling: Deliver wire and cable in accordance with NEMA WC-26. Wires and cables shall not be stored in an exterior or unprotected location. Material subject to direct exposure to the elements shall be replaced and removed from the project. Bring wire to job in original unbroken packages. Obtain approval of University's Representative before installation of wires.

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with the Conditions of the Contract and Division One Specifications Sections for the conductors, terminations, connectors, insulating tape, and insulating kits.
- B. Submit field test reports indicating and interpreting test results required by the "Electrical Equipment Acceptance Testing" section of these specifications.

PRODUCTS

1.5 GENERAL MATERIALS REQUIREMENTS

- A. Provide all materials under this section of the specifications.

- B. All wire and cable shall be UL listed and shall bear a UL label along the conductor length at intervals not exceeding 24 inches.
- C. All conductors shall have size, grade of insulation, voltage and manufacturer's name permanently marked on the outer cover at intervals not exceeding 24 inches.
- D. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall not be less than indicated on the drawings. The minimum size of emergency systems conductors shall be No. 10 AWG.
- E. Insulation voltage level rating shall be 600 volts.
- F. All conduit and conductor sizes indicated on the drawings are based upon copper conductors. 60C ampacities shall be used for sizing of all wire and cable for branch circuits and feeders rated below 125 amps. 75C ampacities shall be used for sizing of all wire and cables for feeders rated 125 amps and above.
- G. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.

1.6 PRODUCT/MATERIALS DESCRIPTION - CONDUCTORS

- A. Conductors shall be stranded copper, 90°C, type THHN/THWN or XHHW unless otherwise indicated on the drawings, required by the California Electrical Code, or specified herein.
- B. Fixture wire shall be No. 16 AWG silicone rubber insulated, stranded fixture wire, type SFF-2 (150°C), or No. 16 AWG thermoplastic, nylon jacketed stranded fixture wire, type TFFN (90°C). Color code as specified herein shall not be required for fixture wire; however, neutral conductor shall be identified distinctly from phase conductors. Conductors connected to vaportight fixtures shall be type AF.
- C. Control conductors for use on 120 volt control wiring systems shall be No. 12 AWG stranded type THHN/THWN, where properly protected, unless indicated otherwise on the drawings. Switch legs are not considered control wiring.
- D. Portable power cables and outlets shall be provided where indicated on the drawings. Cables shall be sized as indicated on the drawings with equal size green equipment ground. Cables shall be jacketed 600 volt SO type. Cable connectors shall be steel case liquid tight sized for cable diameter

and shall use strain relief gland fitting to prevent tension on conductor terminals. Where cable drops are indicated on the drawings, use wire mesh strain relief cable grips at both ends of cable. Use cast type outlet device box for device cable drops.

- E. Wire shall be 1991 Code type copper wire of not less than 98% conductivity. All wires shall be stranded. Wires shall bear the Underwriters' label, be color coded and be marked with gauge, type and manufacturer's name on 24" centers.

1.7 SPLICES, TAPS, AND CONNECTORS

- A. Splices, taps and connectors (No. 10 AWG and smaller) - Splices and joints shall be twisted together electrically and mechanically strong and insulated with approved type insulated electrical spring connectors.
- B. Splices, taps and connectors (No. 8 and larger) - Joints and connections shall be made with Burndy, T & B, or equal, solderless tool applied pressure lugs and connectors. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire and with all irregular surfaces properly padded with "Scotchfil", 2nd product or equal putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1, or equal. Feeder splicing, where permitted, shall be made with high compression sleeve type connector followed by manufactured splicing kit utilizing as insulators, resins poured into a ready-to-use plastic mold to provide a uniform, moisture-proof tough, impact-resistant insulation. Hydraulically applied crimping sleeve or tap connector sized for the conductor. Insulate the hydraulically applied connector with 90°C, 600 volt insulating cover provided by the connector manufacturer. Insulator materials and installation shall be approved for the specific application, location, voltage and temperature and shall not have an insulation value less than the conductor being joined.
- C. Electrical insulating tape shall be 600 volt, flame retardant, cold and weather resistant, minimally .85 mil thick plastic vinyl material; Scotch No. 88, Tomic No. 85, Permacel No. 295, or equal.

EXECUTION

1.8 EXECUTION

- A. Install all wiring in raceway system, except where conductors are indicated or specified not to be installed in raceway. Any conductors found to be damaged or defective, including insulation damaged during installation, shall be removed and replaced at no expense to the University.

1. Pull conductors into raceway simultaneously where more than one is being installed in the same raceway.
 2. Use UL listed pulling compound or lubricant where necessary to reduce cable pulling tension below the manufacturer's recommended levels. Compound used shall not deteriorate conductor or insulation.
 3. Use pulling means, including fish tape, cable rope, or basket-weave wire/cable grips that will not damage cable or raceway.
-
- B. Connect all conductors. Torque each terminal connection to the manufacturers recommended torque value. A calibrated torquing tool shall be used to insure proper torque application.
 - C. Do not install more conductors in a raceway than indicated on the drawings. A maximum of three branch circuits are to be installed in any one conduit, on 3 phase 4 wire system, unless specifically indicated otherwise on the drawings. No two branch circuits of the same phase are to be installed in the same conduit, unless specifically indicated on the drawings.
 - D. Conductors shall be tested to be continuous and free of short circuits and grounds.
 - E. Maintain phase rotation established at service equipment throughout entire project.
 - F. Group and lace with waxed linen lacing cord (T & B "Ty-Rap", Holub "Quik-Wrap" or equal) all conductors within all enclosures, i.e., panels, motor controllers, equipment cabinets, switchboards, etc.
 - G. Splices in homerun conductors to panelboards, switchboards, switchgear, motor control centers, motor control enclosures, and other panels shall be kept to the minimum practicable and shall only be made as necessary to support pulling of the conductors. Make splices in conductors only within junction boxes, wiring troughs and other enclosures as permitted by the California Electrical Code. Do not splice conductors in pull boxes, panelboards, safety switches, switchboard, switchgear, motor control center, or motor control enclosures.
 - H. Splices in conductors installed below grades are not permitted, unless approved in writing by the University's Representative. For taps indicated on the drawings and approved splices below grades, connections shall be made in flush mounted watertight junction box with crimp connectors and watertight resin encapsulating insulating kit. Service entrance conductors shall not be spliced.

- I. Support conductors installed in vertical raceways at intervals not exceeding those distances indicated in the California Electrical Code. Support conductors in pull boxes with bakelite wedge type supports or "Kellem" grips or equal, provided for the size and number of conductors in the raceway. Do not splice conductors in pull boxes used for vertical cable supports unless written permission for splicing is obtained. Where splicing is permitted, make splice with hydraulically applied splicing sleeve.
- J. Terminate conductors No. 10 AWG and smaller specified in Division 26 to be stranded, with crimp type lug or stud. Direct termination of stranded conductors without crimp terminator to terminal screws, lugs, or other points is not permitted even if terminal is rated for stranded conductors. Crimp terminal shall be the configuration type suitable for terminal point.
- K. Make connections between fixture junction box and fixture with fixture wire.
- L. Control, communications or signal conductors shall be installed in separate raceway systems from branch circuit or feeder raceway, unless indicated otherwise on the drawings.
- M. Conductor lengths for parallel circuits shall be equal. Do not configure isolated phasing in separate conduits for parallel conductors.
- N. Install a minimum of twelve inches (300 mm) of slack conductor at each outlet.
- O. Thoroughly clean conductors prior to installing lugs and connectors.
- P. Secure portable cables in accordance with the CEC. Install strain relief devices to prevent tension on terminations if cable is pulled. Install cable grips on drops and connect to outlet box or structure. Leave slack cable loop at drop point.
- Q. All cables and wires passing through manholes and handholes shall be full looped inside the manhole and handhole and supported on galvanized steel racks.

1.9 IDENTIFICATION

- A. Color Code Conductors:
 - 1. Color code all secondary service, feeder and branch circuit conductors. Control and signal system conductors need not be color coded.
 - 2. Coding shall be as follows:

- a. 208Y/120 volt three phase four wire wye system - Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White, Travellers: Orange.
 - b. 480Y/277 volt three phase four wire system - Phase A: Brown, Phase B: Violet, Phase C: Yellow, Neutral: Gray, Travellers: Pink.
 - c. Grounding conductors shall be green. Grounding conductors for isolated ground circuits shall be green with a yellow trace.
3. Phase conductors No. 10 and smaller shall have solid color compound insulation or color coating. Phase conductors No. 8 and larger shall have solid color compound, color coating or colored phase tape. Colored tape shall be installed on conductors in every box, at each terminal point, cabinet, through manhole or other enclosure.
- B. Conductors within pull boxes shall be grouped and identified with nylon tie straps with circuit identification tag.
 - C. Identify each control conductor at its terminal points with wrap around tape wire markers. I.D. to indicate terminal block and point designation, or other appropriate identifying indication.
 - D. Refer to ELECTRICAL IDENTIFICATION section of these specifications for additional identification requirements.

1.10 TESTING

- A. Refer to Electrical Equipment Acceptance Testing section of this specification for testing requirements.

END OF SECTION
26 05 19

SECTION 26 05 20
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Electrical Connections to equipment specified under other sections or as shown on drawings.

1.02 SUBMITTALS

- A. None Required.

1.03 REFERENCE STANDARDS.

- A. Underwriters Laboratories.
- B. NEMA WD5 – Specific Purpose Wiring Devices.

1.04 QUALITY ASSURANCE

- A. Field verify equipment rating with manufacturers nameplate data. Adjust feeders and overcurrent protectors as required to comply with code requirements.

PART II - PRODUCTS

2.01 LUGS

- A. Acceptable Manufacturers.
 - 1. Burndy Corporation.
 - 2. ILSCO Corp.
 - 3. Or Equal
- B. Compression Type: Seamless, one piece, copper, size per conductor applied to, two NEMA Drill.
- C. Set Screw Type: Pin type compression fittings for use on #2 AWG and larger conductor sizes, barrels filled with conductive paste.

2.02 CRIMP ON TERMINALS

- A. Acceptable Manufacturers
 - 1. Thomas-Betts
 - 2. 3M

3. Or Equal

- B. Crimp on, insulated terminals for use on #14 AWG thru #10 AWG conductor size, flanged fork or ring torque style.

2.03 CONNECTORS, SPLICES AND TAPS

A. Acceptable Manufacturers

1. Burndy
2. ILSCO
3. Or Equal

- B. Compression or set screw type with insulating cover for use on #8 AWG and larger conductor.
- C. Split bolt connectors with insulating covers for use on #6 AWG and larger conductor.

2.04 WIRE CONNECTORS

A. Acceptable Manufacturers

1. Ideal Industries
2. Buchanan
3. Or Equal

- B. Conical spring type with nylon or plastic outer shell, color coded to denote wire size, for use on #14 AWG thru #10 AWG conductors.
- C. Butt Compression style insulating crimp splices for use on #14 AWG and smaller conductors.

PART III - EXECUTION

3.01 INSTALLATION

- A. Bus Connection: Use compression lugs, bolt to bus bars using cap screws, lock washers and nuts of material electrically compatible with bus.
- B. Set Screw Connection: Install pin type compression fitting of similar construction as compression lugs.
- C. Terminations to Motors: Use crimp on connectors for motor terminations from stranded conductors and where terminal lugs are not provided by equipment supplier. Use ring-tongue terminals where ever possible.
- D. Use connector manufacturer approved crimping tool to install connectors. Do not remove conducting strands or oversize connector. Apply insulating tape over exposed conductor to 150% of conductor insulating material.

- E. Tighten connections to ensure maximum surface contact between terminals.
- F. Strip insulation per manufacturers instructions, use conductive paste where required.
- G. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices.
- H. Coordinate with other work, including wires, cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- I. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- J. Fasten identification markers to each electrical power supply conductor which indicates their voltage, phase and feeder number in accordance with Electrical Identification section. Affix markers on each terminal conductor, as close as possible to the point of connection.

3.02 INSPECTION

- A. Inspect area and conditions under which electrical connections for equipment are to be installed. Do not proceed with the work until conditions are acceptable for terminations.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installing of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirements. Correct malfunctioning units at site, then retest to demonstrate compliance.
- B. Test all wiring and connections for continuity and grounds; where such test indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.
- C. Provide documentation of all tests as specified by this and other sections in the following formats. Submit in an electronic form (2 copies) and in hard paper form (2 copies). Submit interim test reports to the University's Representative and 'final' acceptance test reports (where only one test iteration is required consider it be the 'final') to the prime electrical contractor (for a single, consolidated submission of all electrical test and O&M's to the University). Compile the electronic copies (including graphics or drawings) entirely in the current version of Acrobat Adobe complete with an interactive field linked Table of Contents (linked to the chapters and subsections within the report). Submit electronic copies on a CD (or CD's).
- D. All electrical systems testing (power and low voltage) as described by each central collection point for all test documentation, whether the tested systems were provided and installed under his contract or not. All Division 16 contractors and vendors are required to cooperate with the prime electrical contractor in this regard and the single submission of tested results shall be considered a contract requirement of all contractors and vendors for all electrical, communication, data, etc. work performed under Division 16.
- E. Provide a copy of the test documentation with the O&M Manual submission.

A/C 9558910
Davis Tower #0711 & 0762 Pharmacy Remodel
Edge Electrical Consulting

END OF SECTION 26 05 20

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Power System Grounding.
2. Communications System Grounding.
3. Electrical Equipment and Raceway Grounding and bonding.

1.02 SUBMITTALS

- A. Submit a complete set of marked-up record drawings to indicate installed location of system grounding electrode connections, and routing of grounding electrode conductor.
- B. Submit certified test results stating ground resistance from service neutral at service entrance.

1.03 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association (NEMA).
- B. American National Standards Institute (ANSI).

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Oz Gedney.
- B. or equal

2.02 MATERIALS

- A. Ground Rods: Copper encased steel **1"** diameter, minimum length – 10'.
- B. Ground Clamp: Water pipe connection, bronze two-piece with serrated jaws, lug sized for grounding electrode conductor.
- C. Connectors, Compression Type: Bronze or Copper, pretreated with conductive paste, sized for conductor to which applied.
- D. Connectors, Exothermic Weld Type: Powder actuated weld. Bond made through exothermic reaction producing molten copper from premixed copper oxide and aluminum powder. Form bond in mold or crucible.

2.03 SECONDARY GROUNDING SYSTEM

- A. The main grounding system shall consist of bare copper ground wires connected to a UFER ground placed below the bottom of the structural slab. The grounding system shall include, but is not limited to ground cables, fittings, connectors and all other devices and material as required to render the system complete and meet the requirements of CEC Article 250. Connect grounding system to all building columns.
- B. Except where specifically indicated otherwise, all exposed noncurrent carrying metallic parts of electrical equipment, metallic raceways systems, grounding conductor in nonmetallic raceways and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment of each service and shall be extended to all required components of CEC Article 250.

2.04 GENERAL BRANCH CIRCUITS GROUNDING

- A. All grounding conductor wire shall be insulated green copper conductors.
- B. All conduit bushings shall be grounding type.
- C. All grounding connections shall be made with solderless lugs and nonferrous hardware.

2.05 CONDUIT BANK GROUNDING

- A. Provide a size 4 /0 bare copper grounding conductor for each of the campus utility distribution conduit banks shown on drawings. Install this grounding conductor within the ground floor slab and parallel to the respective conduit bank.

PART III - EXECUTION

3.01 INSTALLATION OF THE MAIN SERVICE ENTRANCE GROUND

- A. Provide a main service entrance grounding system with cables, connections, and ground buses as shown on the drawings and specified. Provide all necessary materials and testing of the grounding system.
- B. Where available the incoming water service, sprinkler system piping, building steel, UFER ground mat, footing electrode ground rod, and grounding ring encircling the building shall all be bonded together to form a grounding electrode system per CEC Section 250.
- C. Install the grounding system to obtain a ground resistance of the grounding grid not to exceed 5 ohms. Provide testing of the ground grid to obtain a ground resistance rating. If the resistance exceeds 5 ohms, contact the University's Representative for review of installation and additional procedures.

3.02 UFER GROUND SYSTEM

- A. UFER Ground System shall consist of a bare service ground copper ground conductor connected to a UFER ground placed within the structural slab in contact with the earth.
- B. UFER Ground Mat: Form a continuous conductor mat by serpentine bare copper conductor of minimum length 60' in the bottom of the structure foundation footing. The maximum resistance of the ground mat shall not exceed 5 ohms under normally dry conditions. If this ground resistance cannot be obtained with the 60' of mat conductor, additional mat shall be installed in contact with the earth in the bottom of the structural foundation.

3.03 GENERAL BRANCH CIRCUITS AND FEEDERS

- A. All conduit systems, equipment housings, material housings, junction boxes, cabinets, motors, ducts, wireways, cable trays, light fixtures, portable equipment and all other conductive surfaces shall be solidly grounded in accordance with the California Electrical Code to form a continuous, permanent and effective grounding system.
- B. Install a separate green grounding conductor in all conduits, including feeder, branch circuit, and flexible; both metallic and non-metallic. The conduit systems shall not be relied upon as the system equipment grounds. Size all grounding conductors per CEC 250 unless a larger ground is indicated on the drawings. **Secure grounding conductors using approved methods to each pull box, junction box, and equipment housing.**
- C. All panelboards, junction boxes, pullboxes, wireways and equipment enclosures shall be bonded to the conduit systems.
- D. All building expansion joints shall be bonded.
- E. Isolated ground receptacles shall have both an isolated ground conductor and a separate equipment grounding conductor.

3.04 MOTOR CIRCUITS

- A. All motor circuits shall have a ground wire pulled with the phase conductors. The ground wire shall be extended from the panel ground bus and shall be bonded at all junction boxes, pullboxes, disconnect switches, controllers, motor connection boxes, and motor frames. Each motor with a Variable Frequency Drive controller shall have a dedicated grounding conductor. Ground these motors back through the VFD controller as recommended by the drive manufacturer to eliminate radio frequency interference. Also, the wiring between the VFD controller and the motor shall be in a dedicated conduit.

3.05 SEPARATELY DERIVED SOURCES

- A. All secondary neutrals for the 120/208-volt wye services of dry type transformers and UPS equipment shall be grounded to building steel. Connection shall be made with cable sized according to Table **250.102(C)(1)** of the California Electrical Code. Extend separately derived insulated ground to the transformer in rigid steel conduit.

3.06 EQUIPMENT ROOM GROUND TERMINAL BAR

- A. Mount bar by anchors and bolts using 1-½" long segments of ½" rigid conduit as spacer between bar and wall. Use a minimum of two supports, 18" on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar. Each telecom/his room shall have a ground bar with a minimum of six lugs or screws. Interconnect telecom/his ground bars to building steel with No. 6 AWG insulated copper conductor.

3.07 FLEXIBLE RACEWAY GROUNDING

- A. Install a ground conductor inside all flexible raceways (e.g. flexible steel, liquid tight). Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated or required by code, whichever is larger.

3.08 SECTIONAL RACEWAY

- A. Install a ground conductor in all sectional raceways with removable covers for access (e.g., plug-in strips, surface raceways systems, and wireways). Size conductor in accordance with the CEC for the largest phase conductor size installed in raceway, or as indicated. Bond all sections of the raceway to the ground conductor. Connect all receptacle ground terminals in the raceway to the ground conductor, and make other ground connections indicated. This also includes all sectional raceways installed in or on University provided furniture. All surface metal raceways shall be UL listed as an equipment grounding conductor.

3.09 GENERAL GROUNDING REQUIREMENTS

- A. All ground connectors shall be bronze of the clamp type. All clamp accessories such as bolts, nuts, and washers shall also bronze to assure a permanent corrosion-resistant assembly. Connector shall be as manufactured by Burndy Engineering Company, IlSCO Corporation, or equal. Make connections easily accessible for inspection, underground or concealed in floors or walls.
- B. All ground cable splices, joints, and connections to ground rods shall be made with an exothermic welding process which shall provide a weld with current-carrying capacity not less than that of the conductors welded. Soldered connections shall not be used.
- C. All ground wire shall be insulated, unless otherwise indicated on the Drawings, extra flexible stranded copper cables. Grounding cables installed in earth shall be laid slack.
- D. Lighting and power panelboards shall be grounded by connecting a grounding conductor to the grounding stud and to the incoming and outgoing feeder conduits grounding bushings. Each grounding-type bushing shall have the maximum ground wire accommodation available in standard manufacturer for the particular conduit size. Connection to the bushing shall be with wire of this maximum size.
- E. The equipment for the fire protection alarm system shall have its grounding terminal connected to the ground lug on the panelboard serving the system by means of a #6 green coded insulated conductor, run in ¾" steel conduit, utilizing a ground clamp.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Conduit and equipment supports.
 - 2. Fastening hardware.
 - 3. Vibration Isolation.

1.02 SUBMITTALS

- A. Submit for each isolator, complete manufacturer's description including quantity loading and static deflection.

1.03 REFERENCE STANDARDS

- A. American Plywood Association. (APA)
- B. Underwriters Laboratories. (UL) "Building Materials Directory".

1.04 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART II - PRODUCTS

2.01 SUPPORT CHANNELS

- A. Acceptable Manufacturers – Support Channels
 - 1. Unistrut
 - 2. Super Strut
 - 3. Or Equal
- B. Support Channel: 12-gauge galvanized or painted steel, "U" section, 1-½" square nominal in section.
- C. Hardware: Manufacturer's standard as required to support equipment. Provide corrosion resistant finish.

2.02 CONDUIT SUPPORTS

- A. Conduit clamps, straps, and supports shall be steel or malleable iron for all exposed individual conduit runs. Clip type hangers may be used in concealed areas on individual

conduit runs. Group mounted, exposed or concealed shall be supported by trapeze hangers constructed of formed steel channels and threaded rods.

2.03 VIBRATION ISOLATION

- A. Provide vibration isolation in all supporting hardware for vibrating electrical equipment, (e.g., transformers). Isolators shall be as recommended by manufacturer to maximize their effect. Isolators shall be as manufactured by Mason Industries, or equal.

PART III - EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using bolts, beam clamps, and spring steel clips.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, other conduit, or roof deck.
- D. Install all support devices according to manufacturers guidelines and recommendations.
- E. Do not drill through structural framing members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. Install freestanding electrical equipment on concrete pads four inches high and overlapping equipment footprint by two inches on all sides.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall, or on $\frac{3}{4}$ " plywood backboards.
- I. Install plywood backboards over gypsum board or directly to stud framing as indicated. Fasten to studs with self-tapping screws according to APA recommendations.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls with #10 S.M.S. at 12" o.c., 4 minimum, typical unless otherwise noted.
- K. 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.
- L. Do not exceed a maximum point load of 100 lbs. to any member. Locate point loads at least 4' from any other point load on the same member.
- M. All equipment shall be installed in full compliance with all applicable seismic requirements of Title 24, Part 2, CBC.

END OF SECTION 26 05 29

**SECTION 26 05 33
RACEWAYS**

PART I - GENERAL

1.01 DESCRIPTION

- A. This section covers the complete interior and exterior raceway system.
- B. Definition: The term conduit, as used in this Specification, shall mean any or all of the raceway types specified.

1.02 QUALITY ASSURANCE

- A. Referenced Industry Standard: The following specifications and standards are incorporated into and become a part of this Specification by reference.
 - 1. Underwriters' Laboratories, Inc. (UL) Publications:
 - a. No. 1 Flexible Metal Electrical Conduit
 - b. No. 1242 Rigid Galvanized Conduit
 - c. No. 467 Electrical Grounding and Bonding
 - d. No. 651 Rigid Nonmetallic Electrical Conduit
 - e. No. 797 Electrical Metallic Tubing
 - f. No. 1242 Intermediate Metal Conduit
 - 2. American National Standards Institute (ANSI):
 - a. C-80.1 Rigid Galvanized Conduit
 - b. C-80.3 Electrical Metallic Tubing
- B. Acceptable Manufacturers: Products of the following manufacturers, which comply with these specifications, are acceptable.
 - 1. Metallic Conduit Fittings:
 - a. RACO
 - b. Thomas and Betts
 - c. or equal
 - 2. Support Channel:
 - a. Powers
 - b. Unistrut

c. or equal

3. Non-Metallic Conduit and Fittings:

- a. Carlon
- b. Thomas and Betts
- c. or equal

4. Fiberglass Reinforced Epoxy Conduit Systems:

- a. FRE Conduit, Inc.
- b. United Fiberglass
- c. or equal

C. Coordination

- 1. Coordinate conduit installation with electrical equipment furnished.
- 2. Coordinate conduit installation with contract documents. Adjust installation to eliminate conflicts. Review all shop drawings submitted under this and other sections to insure coordination with all equipment requiring electrical service and to avoid conflict interferences. Coordinate installation sequence to avoid conflicts including equipment access and provide the fastest overall installation schedule.

1.03 STORAGE AND HANDLING

- A. Refer to the Basic Electrical Requirements section of the specifications for storage and handling requirements.
- B. Non-metallic conduits stored on-site prior to installation shall be stored on a surface off of the ground and shall be protected from the direct rays of the sun and from debris.
- C. Damaged, oxidized, warped, improperly stored material or material with excessive amounts of foreign debris will be removed from the project and replaced with new materials, at no cost to the University.

PART II - PRODUCTS

2.01 GENERAL MATERIALS REQUIREMENTS

- A. Furnish all materials specified herein.
- B. All conduit and fittings shall be listed and bear a label by Underwriters' Laboratories (UL) for use as raceway system for electrical conductors.

- C. Raceway is required for all wiring, unless specifically indicated or specified otherwise.
- D. Size: The minimum size of conduit shall be $\frac{3}{4}$ ". The size of all conduits shall be in accordance with the CEC using 30% fill, but not less than indicated on the drawings.
- E. Bushings shall be metallic insulated type. Weatherproof or dust-tight installations shall be liquid-tight with sealing ring and insulated throat. Bushing shall be OZ/Gedney type KR, or equal (Or equal, no known equal.)
- F. Expansion and deflection fittings shall be OZ/Gedney, type DX, or equal
- G. All under floor/ground raceways will be cleaned and mandrilled before wire is installed.

2.02 EMT CONDUIT AND FITTINGS

- A. Electrical Metallic Tubing shall conform to UL 797, cold rolled steel tubing with zinc coating on outside and protective enamel coating on inside.
- B. Electrical Metallic Tubing (EMT) couplings and connectors shall be steel compression "concretetight" type. Malleable iron, die cast or pressure cast fittings are not permitted. All connectors shall be nylon insulated throat type. Fittings shall meet same requirements for finish and material as EMT conduit. Box connectors shall be equipped with insulated throat.
- C. Connectors at cabinets, boxes, and gutters shall be metallic nylon grounding type with insulated bushings.

2.03 RIGID AND IMC CONDUIT and FITTINGS

- A. Intermediate metallic conduit and rigid steel conduit shall conform to UL 6, standard weight, mild steel pipe, zinc coated on both inside and outside by a hot dipping or sherardizing process. Inside and outside of conduit shall be finished with a protective coating.
- B. Fittings for rigid steel and IMC shall be standard threaded couplings, locknuts, bushings and elbows. Fittings shall be assembled with anti-corrosion, conductive anti-seize compound at joints made absolutely tight to exclude water. All materials shall be steel or malleable iron only. Setscrew or non-thread fittings are not permitted.
- C. Bushings shall be metallic insulating type consisting of insulating insert molded or locked into the metallic body of the fittings.
- D. Erickson-type couplings may be used to complete a conduit run. IMC couplings may be the integral retractable (Uni-Couple) type.
- E. Connectors at cabinets, boxes, and gutters shall be metallic nylon grounding type with insulated bushings.

2.04 NON-METALLIC CONDUIT AND FITTINGS

- A. Non-metallic conduit shall be heavy wall, Schedule 40 PVC or Schedule 80 PVC.
- B. Non-metallic conduit fittings shall be of the same material as the conduit furnished and be the product of the same manufacturer. PVC 90° bends shall not be used. Wrapped rigid will be used in its place. Double lap of Calpico 10 mil or approved equal.

- C. Maximum length of non-metallic conduit shall be twenty feet. Mark each length clearly and durably with nominal trade size, type of material, and UL label.
- D. Material shall have tensile strength of 7,000 psi at 73.4°F, flexural strength of 11,000 psi and compression strength of 8,600 psi.
- E. Non-metallic conduit shall be suitable for direct burial without concrete encasement.
- F. All joints shall be solvent welded, 1" minimum size unless indicated on drawing.
- G. All underground or underfloor conduit shall be cleaned and mandrelled before wire is installed.

2.05 FIBERGLASS REINFORCED EPOXY CONDUITS

- A. Rigid non-metallic fiberglass reinforced epoxy conduits (FRE) shall be composed of glass filaments encapsulated in an epoxy matrix. All FRE conduits and fittings shall be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for UV protection. Conduit shall be suitable for continuous operation from -40°C to +110°C.

2.06 CONDUIT SUPPORTS

- A. All parts and hardware shall be zinc-coated or have equivalent corrosion protection.
- B. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.
- C. Conduit support channels shall be 1.5" x 1.5" x 14 gauge galvanized (or with equivalent treatment) channel. Channel suspension shall be minimum ¼" threaded steel rods. Spring steel clips are not acceptable. Conduit straps shall be spring steel conduit straps compatible with channel. Wire or chain is not acceptable for conduit hangers. All installations shall meet applicable seismic requirements.
- D. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose, sized appropriately for the conduit type and diameter, and have pre-assembled closure bolt and nut and provisions for receiving threaded hanger rod. Support with ¼" threaded steel rod for individual conduits 1.5" and smaller and ⅜" rod for individual conduits 2.0" and larger. All installations shall meet applicable seismic requirements.
- E. Individual conduit straps on metal studs shall be spring steel and should wrap around entire face of stud securely biting into both edges and have provisions for screwing into stud. Size for conduit to be support. Tie wraps are not acceptable.
- F. Support multiple conduits from metal studs using pre-assembled bar hanger assembly consisting of hanger bar, retaining clips and conduit straps.
- G. Refer to Section 16190 of these specifications for additional material requirements. Refer to Seismic Control for additional seismic requirements.

2.07 FLEXIBLE CONDUIT AND FITTINGS

- A. Flexible conduit shall be steel metallic type, zinc coated on both inside and outside by hot dipping or sherardizing process.

- B. Where specified herein, indicated on the drawings, or when used in damp or wet locations, as classified by the California Electrical Code, flexible conduit shall be liquid tight. Liquid-tight conduit shall be galvanized with extruded polyvinyl covering and with water-tight connectors.
- C. All flexible conduit shall be classified as suitable for system grounding.
- D. Connectors for flexible conduit shall be steel insulated throat type rated as suitable for system ground continuity. Connectors for liquid tight flexible conduit shall be screw-in ground cone type.
- E. Flexible conduit shall not be less than ¾" trade size and in no case shall flexible conduit size be less than permitted by the California Electrical Code for the number and size of conductors to be installed herein.
- F. No aluminum flexible conduit shall be used.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND ACCESSORIES

- A. Vinyl all weather electrical tape for corrosion protection shall be Scotch #88, Tomic #85, Permacel #295 or equal.
- B. Expansion and deflection couplings shall be in accordance with UL 467 and UL 514. They shall accommodate ¾" deflection, expansion, or contraction in any direction and shall allow 30° angular deflections. Couplings shall contain an internal flexible metal braid to maintain raceway system ground continuity.
- C. Fire and smoke stop materials shall be UL rated to maintain the fire floor or firewall partition rating.

PART III - EXECUTION

3.01 INSTALLATION

- A. General
 - 1. Conceal all conduits, except in unfinished spaces such as equipment rooms or where indicated by symbol on the drawings or as approved by the University's Representative. Run concealed in areas having finished ceilings and furred walls. Run all cross conduits and vertical risers or drops concealed in wall and/or partitions. Run vertical risers or drops up or down between wall studs. Should it be necessary to notch any framing members, notch only at locations in a location and manner approved by University's Representative.
 - 2. Exposed conduit below 8'-0" shall be rigid type.
 - 3. Provide flexible connections of short length to equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor in all flexible connections.
 - 4. Support conduits per seismic guidelines outlined in section 16012.
 - 5. Maintain a minimum of 6" clearance from conduit to steam or hot water pipes.
 - 6. Leave all empty conduits with a galvanized pull wire or nylon pull rope.

7. Install as complete raceway runs prior to installation of cables or wires.
8. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
9. Secure rigid conduit i.e., rigid galvanized conduit and intermediate metal conduit, to sheet metal enclosures with two (2) locknuts and insulated bushing. Secure EMT to sheet metal enclosures with insulated throat connectors.
10. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel. Nails are not acceptable.
11. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until all masonry is complete. Protect conduit stud-ups during construction from damage; any damaged conduits shall not be used.
12. Seal all conduits originating from outside building from below grade, all conduits entering refrigerated spaces, i.e., freezers and coolers, and all conduits entering exterior mounted electrical equipment with insulating electrical putty to prevent entrance of moisture. Waterproofing material shall not contain creosote or polysulfides which are not compatible with the waterproofing system.
13. Install conduit with wiring, including homeruns as indicated on the drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by University's Representative by written authorization.
14. Where conduit passes through finished walls or ceilings, provide steel escutcheon chrome plates or paint as directed.
15. Provide sleeves for conduit passing through floor slabs and/or concrete masonry walls.
16. Conduits which penetrate roof membranes shall be installed in accordance with manufacturer's recommendations and architectural specifications.
17. Separate raceway systems are to be installed for power systems and for control, signal and communications systems. Do not install control, signal or communications cables in the same raceways as branch circuit or feeder cables, unless indicated otherwise on the drawings.
18. Provide expansion fitting in all conduits where length of run exceeds 200' or where conduits pass building expansion joints.
19. Telephone, and data, and all service entrance conduits shall be installed with wide sweep 90° bends; minimum radius shall be 60".

B. Uses Permitted

1. Galvanized rigid conduit or IMC shall be used as follows:
 - a. 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.
- b. Buried in or in contact with earth to be half-lapped with omic pipe wrapping tape with sealant applied to all joints.
 - c. In poured concrete walls or block walls, in concrete vaults, floor and roof construction, provided a minimum of 2" of cover is maintained.
 - d. In all walls up to the first outlet box where fed from rigid conduit in damp locations or locations exposed to the weather.
 - e. In exposed locations below 8' above the floor, including all mechanical rooms.
 - f. All elbows for underground plastic conduit.
 - g. All conduits for interior wiring systems whose voltage is above 600 volts.
 - h. All conduits entering refrigerated spaces.
 - i. Elsewhere where indicated on the drawings.
 - j. For emergency branch feeders and circuits installed outside of building.
2. Electrical metallic tubing (EMT) shall be used as follows:
- a. Concealed in stud partitions and hollow masonry walls.
 - b. For connections from junction box to lighting fixtures except in accessible ceilings.
 - c. Above In
 - d. suspended or accessible ceilings above 8'.
 - e. Exposed in dry locations above 8 feet where not subjected to mechanical damage.
 - f. In furred ceiling spaces.
 - g. For fire alarms system conduit. Paint red 6" wide every eight feet.
3. Rigid non-metallic conduit shall be used as follows:
- a. For the branch circuit wiring for exterior lighting pole bases and bollards (horizontal runs only).
 - b. All elbows, both vertical and horizontal, shall be GRC.
 - c. Any non-metallic PVC conduit used for emergency power systems shall be schedule 80 PVC.
 - d. The communications conduit shall be schedule 40 PVC.

4. 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).
5. Conduit types shall not be mixed indiscriminately with other types in the same run, unless specified herein or required by the CEC.
6. Use flexible conduit for connections to motors, dry type transformers, electrical duct heaters, unit heaters, expansion joints, and flush mounted lighting fixtures. Conduit must be secured.
 - a. Flexible conduit used for connection of motor, dry type transformers, electric duct heaters, and unit heaters, shall not exceed 18" in length.
 - b. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 3 feet in length.
 - c. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
 - d. 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.
7. Service entrance conduits shall be installed "outside" of the building as defined by the CEC. Provide concrete encasement where required.
8. 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.
9. Where hazardous locations, as classified by the California Electrical Code, exist, all conduits and fittings and the installation of these materials shall comply with Article 500 of the California Electrical Code.
10. LB condulets for conduits larger than 1-½" I.D. shall not be used unless of the mogul design and secured to the building structure within 6" below and along the side of the condulet.

C. Below Grade Raceway Installations

1. Direct Burial Conduit
 - a. Unless otherwise indicated install top of conduits 24" minimum below finished grade. Maximum depth shall be 36". Utility primary conduit shall be 48" 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.
 - b. Install top of conduits 18" minimum below bottom of building slabs.
 - c. Install top of conduits 30" minimum below grade, below roads and any other paved surfaces.

- d. Place a 4" wide, bright yellow, non-biodegradable plastic tape 12" above all underground conduit outside of building foundation.
- e. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab, and at transition at manholes and service switchgear, 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 or coat with bituminous asphaltic compound, for 6" above and below concrete surface.
- f. For excavation and backfilling, refer to Section 16010 and Division 2 of these specifications.
- g. Conduit shall be run following the most direct route between points and the route shall be coordinated with other disciplines.
- h. All open conduit ends shall be plugged during construction to prevent water, mud, concrete and debris from entering. Prior to the installation of cables, each conduit shall be cleaned by pulling a standard, flexible mandrel not less than 12" long, with diameter approximately 1/4" less than inside diameter of conduit, through the conduit. In addition, a brush with soft bristles and diameter approximately equal to inside diameter of conduit shall be pulled through conduit.
- i. For all underground runs of two or more conduits, separators or spacing blocks made of plastic or other suitable nonmetallic, nondecaying 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.
- j. Before installing the last 8" of lift of backfill for all primary feeders and for secondary service feeders, install plastic identification tape warning of buried electrical lines the full length of duct bank trench.

D. Raceway Installations Within Concrete

1. Conduit can only be installed within concrete where shown on the drawings or with the agreement of the Structural Engineer of Record
2. Conduit shall be run following the most direct route between points.
3. Conduit shall not be installed in concrete which is less than 3" thick or where the outside diameter is larger than $\frac{1}{3}$ of the slab thickness.
4. Conduits installed in concrete slabs shall be buried in the concrete slab. Wire low conduits to upper side of the bottom reinforcing steel, and upper conduits to the lower side of the top reinforcing steel. Separate parallel runs of conduits within slab by at least 3".
5. 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.
6. Protect each metallic conduit installed in concrete slab or conduits 1.5" and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
7. Conduit stub-up penetrations through slabs shall be installed with the top of a threaded conduit coupling flush with the finished slab.
8. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
9. Install all conduits penetrating rated fire floors to maintain the fire and thermal rating of the floor penetrated.

E. Concealed (Above Ceilings and in Walls) and Exposed Raceway Installation

1. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members.
2. Support branch circuit conduits at intervals not exceeding 10' and within 3' of each outlet, junction box, cabinet or fitting. Attach individual branch circuit conduits to structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hangar rod and conduit clamp assembly. Multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
3. Attach feeder conduits larger than 1" trade diameter to or from structure on intervals not exceeding 10' with conduit beam clamps, one hole conduit straps or trapeze type support in accordance with support systems described for branch circuit conduits.
4. Single-flange clamps are unacceptable
5. Exposed conduits shall be painted, see Section 09900 of the specifications.

6. For fire alarms system conduit. Paint red 6" wide every eight feet.
7. Install conduit sleeves in slabs where conduits 2.0" and larger pass through. Sleeves shall extent 1" minimum above finished slab. Seal all spare sleeves and between conduits and sleeves to maintain fire rating and to make watertight and smoketight.
8. Install all conduits or sleeves penetrating rated firewalls or fire floors to maintain fire rating of wall or floor.
9. Conduits rigidly secured to building construction on opposite sides of a building expansion joint shall be provided with an expansion and deflection coupling. In lieu of an expansion coupling, conduits 2-1/2" and smaller may be provided with junction boxes on both sides of the expansion joint connected by 15" of slack flexible conduit with bonding jumper.

3.02 ADJUSTMENT, CLEANING AND PROTECTION

- A. Clean: Upon completion, clean all installed materials of paint, dirt, and construction debris. All conduit systems shall be cleaned of water and debris prior to the installation of any conductors.

END OF SECTION 26 05 33

**SECTION 260535
ELECTRICAL BOXES AND FITTINGS**

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pressed Steel Boxes and Fittings.
 - 2. FS and FD Boxes.

1.02 SUBMITTALS

- A. None required.

1.03 REFERENCE STANDARDS

- A. Underwriters Laboratories (UL).
- B. National Electrical Manufacturers Association (NEMA) #250 - Enclosures for Electrical Equipment.
- C. NEMA 051 - Sheet steel outlet boxes, device boxes, covers and box supports.
- D. NEMA 052 - Non-metallic outlet boxes, covers and box supports.

PART II - PRODUCTS

2.01 STEEL BOXES AND FITTINGS

- A. Acceptable Manufacturers:
 - 1. Midwest Electric
 - 2. RACO
 - 3. or equal
- B. Boxes to be non-gangable, having knockouts as required and compatible covers or extension rings suitable for installed devices.
- C. Boxes to be galvanized stamped steel, with grounding lug tapped hole.
- D. Provide $\frac{3}{8}$ " fixture studs in ceiling outlet boxes where required.

2.02 FS AND FD BOXES

- A. Acceptable Manufacturers:
 - 1. Appleton

2. Crouse - Hinds
 3. or equal
- B. Provide cast iron alloy boxes with epoxy paint or galvanized finish. Aluminum or pot metal boxes are not acceptable. Boxes shall have threaded hubs sized for conduit without adapters and threaded holes for securing cover. Device boxes shall be provided with proper weatherproof, gasketed cover assemblies, junction and pull boxes shall be provided with flat gasketed covers. Fixture boxes shall be 4" round or as required for the fixture. Junction and pull boxes requiring more than one gang shall be multi-gang FS or FD or dimensioned cast boxes with cast covers.

PART III - EXECUTION

3.01 GENERAL

- A. Install all boxes so they are completely covered by the wall plate or fixture.
- B. Provide galvanized one-piece or welded pressed steel boxes and fittings unless indicated otherwise. Provide galvanized steel outlet box covers for surface mounted galvanized steel boxes in unfinished areas. Boxes in unfinished areas, installed exposed, shall be cast type "conduit" for switches and convenience outlets. Exposed boxes mounted below 8' from finished floor shall be cast type. Provide blank cover for all boxes without fixture or device.
- C. Provide FS and FD boxes and required covers surface mounted in damp or wet locations and as indicated on plans. Boxes shall be securely mounted using mounting lugs or other method made in a way so as not to degrade the weatherproof nature of the system.
- D. Install all outlet boxes rigidly, plumb, and level. Secure outlet boxes to ceiling system support members and wires using only clips designed and approved for the purpose. Do not cut insulation in outside walls to install outlet boxes. Do not use through-the-wall boxes unless specifically noted. Do not install boxes back-to-back in adjoining rooms. Offset outlet boxes installed back-to-back in fire-rated walls and partitions a minimum of 24 inches horizontally. Protect boxes during construction to prevent entrance of foreign materials such as concrete, mortar, plaster, paint, etc.
- E. Flush mounted boxes shall be installed with opening edge flush with finish surface.
- F. Pull boxes shall be provided in all runs of 90' or more in length or such that not more than four 90° bends occur between boxes. Junction and pull boxes shall be located in accessible locations and shall be concealed in finished work and shall be permanently identified with system label. Where concealed accessible space is not available in finished areas, boxes shall be flush mounted with rings and blank plates at standard boxes, flanges and plaster stops at large boxes. Flush boxes shall be carefully aligned to be plumb. Locations to be coordinated with University's Representative prior to installation.
- G. 4" octagonal boxes or square boxes with plaster rings shall be used for ceiling or wall light fixture outlets. Boxes for fixtures shall be equipped with fixture studs. Boxes shall be supported as required to carry loads as required by code. Other ceiling outlets shall be 4" square or larger with plaster rings unless indicated otherwise on drawings. Boxes shall be flush mounted or concealed in finished construction.

- H. Provide minimum of $\frac{3}{4}$ " plaster rings designed for the purpose for outlet boxes in plaster or gypsum board walls.
- I. Provide masonry boxes and extension rings for boxes in concrete block, brick, and glazed tile walls. Secure with auxiliary plates, bars or clips and grout in place.
- J. Install outlet device mounting rings such that they extend no more than $\frac{1}{16}$ ", or are recessed no more than $\frac{3}{16}$ " from wall surface.
- K. Support all outlet boxes independently from the raceway systems. Securely support by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rust inhibitor.
- L. Install outlet boxes for electric water coolers concealed inside cooler cabinets. Locate outlet boxes as recommended by equipment supplier.
- M. For dimensional locations of the actual installed location shall not vary from the dimensioned location by more than plus or minus one-half inch, unless otherwise noted.
- N. Boxes for local switches shall be at least 1- $\frac{1}{2}$ " deep 4" square for 1 or 2 gang switches, with switch plaster rings and gang box with gang cover.
- O. Boxes for telephone and data shall be minimum 2- $\frac{1}{8}$ " deep.
- P. Use screws and not nails to support outlet boxes.
- Q. Nails shall not be used to support outlet boxes. Boxes must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry, tile, or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.

END OF SECTION 260535

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 DESCRIPTION

- A. Extent of electrical identification work is as outlined by this specification.
- B. Types of electrical identification work specified in this section include the following:
 - 1. Buried cable warnings.
 - 2. Electrical power, control and communication conductors.
 - 3. Operational instructions and warnings.
 - 4. Danger signs.
 - 5. Equipment/system identification signs.

1.02 QUALITY ASSURANCE

- A. CEC Compliance: Comply with CEC as applicable to installation of identifying labels and markers for wiring and equipment.
- B. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
- C. ANSI Compliance: Comply with applicable requirements of ANSI Std A13.1, "Scheme for the Identification of Piping Systems".
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std No's WC-1 and WC-2 pertaining to identification of power and control conductors.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical identification materials and products.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
 - 1. Brady, W.H. Company
 - 2. Panduit Corporation

3. or equal

2.02 ELECTRICAL IDENTIFICATION MATERIALS

- A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, provide single selection for each application.
- B. Color-Coded Plastic Tape:
 - 1. Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-½" wide.
 - a. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.
- C. Underground-Type Plastic Line Marker:
 - 1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.
- D. Cable/Conductor Identification Bands:
 - 1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.
- E. Plasticized Tags:
 - 1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-¼" x 5-⅝", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.
- F. Self-Adhesive Plastic Signs:
 - 1. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.
 - 2. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.
 - 3. Baked Enamel Danger Signs:
 - 4. General: Provide manufacturer's standard DANGER signs of baked enamel finish on 20-gauge steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with

recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

G. Engraved Plastic-Laminate Signs:

1. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: $\frac{1}{8}$ ", except as otherwise indicated.
3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART III - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of CEC and OSHA.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification:

1. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

C. Box Identification:

1. After completion, using an indelible wide tip marker, indicate on the cover of each junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5. Use a black marker for normal power circuits a red marker for critical circuits, an orange marker for life safety circuits, and a green marker for equipment circuits.

2. All junction and pull boxes for wiring systems above 600V shall be identified with high voltage warning labels installed every 20 linear feet in accordance with OSHA standards. All boxes shall also be painted red, see Section 09 91 23 of the specifications.
3. All junction and pull boxes for the fire alarm system shall be painted red. All raceway for the fire alarm system shall be labeled "Fire Alarm" in red letters on intervals not to exceed ten feet.

D. Underground Cable Identification:

1. During back-filling/top-soiling of each exterior underground electrical, signal or communication conduits, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
2. Install line marker for every buried conduit.

E. Cable/Conductor Identification:

1. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panel boards, shop drawings, contract documents, and similar previously established identification for project's electrical work. Refer to Section 26 05 19 of these specifications for color-coding requirements.

F. Operational Identification and Warnings:

1. Wherever required by OSHA or directed by the University, to ensure safe and efficient operation and maintenance of electrical systems, including prevention of misuse of electrical facilities equipment by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposed. Request a meeting with the University prior to substantial completion to coordinate warning requirements.

G. Danger Signs:

1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations identified by the University as constituting similar dangers for persons in or about project. Request a meeting with the University prior to substantial completion to coordinate danger sign requirements.
 - a. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

- b. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

H. Equipment/System Identification:

1. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, ½" high lettering, on 1-½" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
 - a. Electrical cabinets and enclosures.
 - b. Access panel/doors to electrical facilities.
 - c. Transformers.
 - d. Fire alarm control panel, battery cabinets, voice alarm system cabinets, and transponders.
 - e. Automatic transfer switches.
2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate. Identification of flush mounted cabinets and panel boards shall be on the inside of the device.
3. Panel boards, individually mounted circuit breakers, and each breaker in the switchboards, secondary unit substations, and distribution panels shall be identified with an engraved plastic laminate sign. Plastic nameplates shall be multicolored laminated plastic with faceplate and core as scheduled. Lettering shall be engraved minimum ¼" high letters.
 - a. 480/277-volt normal power equipment shall be identified with white faceplate with green core.
 - b. 480/277-volt critical branch power equipment shall be identified with white faceplate with yellow core.
 - c. 480/277-volt life safety branch power equipment shall be identified with white faceplate with red core.
 - d. 480/277-volt equipment branch power equipment shall be identified with white faceplate with blue core.
 - e. 208/120-volt normal power equipment shall be identified with green faceplate with white core.

- f. 208/120-volt critical branch power equipment shall be identified with yellow faceplate with white core.
- g. 208/120-volt life safety branch power equipment shall be identified with red faceplate with white core.
- h. 208/120-volt equipment branch power equipment shall be identified with blue faceplate with white core.
- i. Equipment identification is to indicate the following:
 - 1) Equipment ID abbreviation.
 - 2) Voltage, phase, wires and frequency.
 - 3) Emergency or other system.
 - 4) Power source origination.

Example: Panel SLGHA1
480/277V, 3 Ø, 4 W
Life Safety System
Fed by EM1
- j. Submit complete schedule with the shop drawings listing all nameplates and information contained thereon.

END OF SECTION 26 05 53

SECTION 26 05 73
SHORT CIRCUIT AND COORDINATION REPORT

PART I - GENERAL

1.01 DESCRIPTION

A. GENERAL:

1. This section specifies that the Contractor will adjust, set and test all adjustable short circuit and overcurrent protective devices. The Contractor will provide the University with a short circuit and coordination report which will contain the settings for the protective devices.

B. SCOPE:

1. The following equipment and associated devices will be included in the scope of the short circuit and coordination study:
 - a. 12.47 kV normal power switchgear.
 - b. 12.47 kV emergency power switchgear.
 - c. 20.8 kV – 12.47 kV transformers.
 - d. 12.47 – 4.16 kV transformers.
 - e. 12.47 – 0.48 kV transformers.
 - f. 4.16 kV switchgear, bus and motor starters.
 - g. 480-volt switchgear and switchboards.
 - h. 480-volt motor control centers.
 - i. 480-volt transfer switches.
 - j. All 12.47 kV cables.
 - k. All 4.16 kV cables.
 - l. All 480-volt feeder cables.
 - m. All 480-volt motors 50 HP and larger together with motor starters.
 - n. All medium voltage bus ducts.

PART II - DELETED
PART III - EXECUTION

3.01 GENERAL

- A The Contractor shall adjust and set all protective devices associated with the equipment specified in paragraph 26 05 73 – 1.01. Settings will be provided to the University by the Contractor.

3.02 TESTING

- A Protective devices shall be tested in accordance with Section 26 90 90.

END OF SECTION 26 05 73

SECTION 26 27 26 WIRING DEVICES

PART I - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Wall Switches
 - 2. Receptacles
 - 3. Device Plates
 - 4. GFI Receptacles
 - 5. Incandescent Dimmers

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Division 1.
- B. Provide manufacturers product specification sheets for all specified devices.
 - 1. Include specific color, material and finish.
 - 2. Include manufacturers catalog device number.
 - 3. Include manufacturers spec data to specifically indicate conformance with these specifications.
- C. Samples: Provide device and plate samples if indicated or requested by the University's Representative.

1.03 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association.
 - 1. NEMA WD-1 - General Purpose Wiring Devices.
 - 2. NEMA WD-5 - Specific Purpose Wiring Devices.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Leviton
- B. Pass and Seymour/Sierra
- C. or equal

2.02 WALL SWITCHES

- A. Type: Quiet toggle AC heavy-duty rated 20 ampere at 120/277 volt. Provide the configuration listed in the table below or as indicated.
- B. Grade: Heavy-duty industrial grade. Refer to reference manufacturer below.
- C. Construction: Back and side wired, with silver alloy contacts and screw down wire termination clamps. Switch shall be self-grounding and include a grounding screw terminal.
- D. Color: Toggles shall be ivory color finish. Switches on critical or equipment branch power shall be red. Verify color with University's Representative prior to order.
- E. Key Switch: Provide locking type switch with key where indicated. Provide key with each switch.
- F. Pilot switches: Lighted handle type with red pilot illuminated when switch is in "On" position.
- G. Reference Manufacturer: Leviton catalog numbers are used in the following table to identify specific switches and grade:

<u>Poles</u>	<u>Amps</u>	<u>Volts-AC</u>	<u>Cat. No.</u>	<u>Remarks</u>
Single	20	277	1221-2	Toggle-Quiet
Double	20	277	1222-2	Toggle-Quiet
Three Way	20	277	1223-2	Toggle-Quiet
Four Way	20	277	1224-2	Toggle-Quiet
SPDT	20	277	1257	Momentary Contact
Single	20	120/277	1221PLR	Pilot
Single	20	277	1221-2L	Locking Type
Single	20	277	1221 w/cover	Weather Proof

2.03 RECEPTACLES

- A. Type: Standard straight blade or locking as indicated. Convenience outlets shall be rated at 20 amperes at 125 volts, composition base with slots to accommodate parallel plug caps with grounding peg unless indicated otherwise on drawings.
- B. Grade: UL listed Hospital grade unless specification grade is indicated as acceptable on drawings. Refer to reference manufacturer below.
- C. Construction: Back and side wired with screw down wire termination clamps of the voltage and configuration indicated. Body constructed of thermoplastic, nylon or urea with wrap-around steel strap. Face construction of a polycarbonate or nylon. Self-grounding with a grounding screw terminal.
- D. Color: Face shall be ivory. Receptacles with special configurations not available in specified color shall be black. Receptacles on critical, life safety, or equipment branch power shall be red.

- E. Configuration: NEMA 5-20R, unless identified on the drawings by another NEMA configuration number.
- F. Isolated Ground Type: Provide only where indicated. Color of receptacle face shall match other 5-20R receptacles. Receptacle shall have orange dot isolated ground identification.
- G. Reference Manufacturer: Leviton catalog numbers, unless otherwise noted are used in the following table to identify specific receptacles

<u>Poles/ Wires</u>	<u>Volts</u>	<u>Amps</u>	<u>NEMA Configuration</u>	<u>Cat. No.</u>	<u>Use</u>
2P-3W	125	20	5-20R	8300	General Duplex
2P-3W	125	20	5-20R	7899-HG	General GFI Duplex
2P-3W	125	30	5-30R	5371	Equipment Single
2P-3W	250	20	6-20R	5461	Equipment Single
2P-3W	250	30	6-30R	5372	Equipment Single
2P-3W	125	20	5-20R	P & S. TR63-H	Tamper Resistant
2P-3W	125	20	5-20R	8300-IG	Isolated Ground

2.04 G.F.I. RECEPTACLES

- A. Type: 120 volt 20 ampere duplex feed through type.
- B. Color: Face color to match other 5-20R receptacles.
- C. Grade: Hospital Grade
- D. Operation: Differential current sensing device capable of detecting ground fault currents of 5 milliamps, plus or minus 1 milliamp and interrupt the supply circuit within the UL trip time curve.
- E. Test and Reset: Provide a test and reset button on the receptacle.
- F. Exterior Installation: Install in FS box with weatherproof cover as specified.
- G. All receptacles in restrooms within 6' of sink, outdoors, roof tops, indoor wet locations, kitchens, locker rooms with associated showering facilities, garages, and at water fountains shall be ground fault interrupter type.

2.05 DEVICE PLATES

- A. Scope: Switches, receptacles, telephones and all other outlets (including signal systems and blank outlet boxes) shall be covered with specified plate. All plates shall match and be of the same manufacturer.
- B. Type: Smooth no-line with rounded edges and corners. Standard size.
- C. Color, Material and Locations:
 - 1. Stainless Steel: Brushed stainless steel with stainless steel screws at all locations, except as indicated below.

2. Unfinished Areas: In tunnels, above ceilings and in unfinished areas, device plates shall be galvanized steel utility type.
3. Weatherproof Outlets: Provide cast aluminum plate with a hinged backing double lift cover and gasket allowing either surface or recessed mounting. Plate shall allow horizontal mounting of a duplex receptacle with a horizontal hinge. Hubbell #5205 or equal for standard boxes or Hubbell #5206 or equal for FS boxes. GFI outlets shall be provided with an appropriate cover.
4. Clock outlets: Provide 302 stainless steel with a hanging bracket and regressed receptacle. P&S #S3733-SS, or equal.

D. Engraving:

1. All device plates shall be engraved on the face with 1/4" high black letters. Special purpose device plates, including fan motor controls, special voltages, sound system outlet identification, and special signal system identification, shall be engraved identifying use. Special receptacles shall be identified with voltage, amperage, and phase. All other devices, including receptacles and light switches, shall have panel number and circuit number engraved.
2. All critical and life safety branch outlet plates shall be engraved with red letters.
3. All device plates shall be of the same manufacturer.

2.06 LED DIMMERS

- A Refer to Section 26 51 10.

PART III - EXECUTION

3.01 INSTALLATION

A. Light Switches:

1. 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.
2. Verify with the University's Representative the correct room numbers and terminology before engraving plates.
3. Install all single pole switches with "on" in the up position and "off" in the down position.
4. Mount switches at the elevation indicated on the drawings. Dimensions are to the center of the box. For masonry walls, adjust height as required to install end of device at the nearest mortar joint.

B. Receptacles:

1. Where receptacles are shown adjacent to other devices, the boxes shall be installed with 2" between devices of other systems.

2. Mount receptacles at the elevation indicated on the drawings. Mounting heights are to the center of the outlet. For masonry walls, adjust height as required to install end of device at the nearest mortar joint.
3. Mount receptacle vertically with the grounding U at the top.

C. G.F.I. Receptacles:

1. Install ground fault receptacles at all receptacle locations indicated on the plan as G.F.I.
2. Where a number of receptacles in sequence are marked G.F.I., the first receptacle shall contain the sensing interrupting device and the remainder shall be standard receptacles served from the protected feed through connection.

D. Plates:

1. Coordinate multiple gang plates for proper arrangement, openings and engraving.
2. Provide blank plates mounted on the outlet box for all empty conduit systems.
3. Plates shall match and shall be mounted square with the building structure.
4. Provide cadmium plated cover plates for surface boxes in unfinished spaces.
5. Secure plates to device or box with proper attachment screws.

3.02 WIRING AND CONNECTIONS

- A. Terminate ground wire at device where ground wire is provided within the raceway system.
- B. Carefully strip thermoplastic wire to length and make-up terminal connection as recommended by the device manufacturer.
- C. Secure device to outlet box with proper screws.

3.03 TESTING AND INSPECTION

- A. Test all receptacles for ground continuity and polarity.
- B. Test all GFI interrupting receptacles.
- C. Inspect all devices for defective operation or breakage, cracks or chips. Replace defective devices or devices damaged during construction.

3.04 TELECOMMUNICATIONS SPACE (TS) ELECTRICAL REQUIREMENTS

- A. Convenience duplex receptacles shall be:
 1. Mounted in each room at +18 inches AFF and horizontally spaced not to exceed 6-feet around the perimeter of the room.

2. Non-switched, 120VAC 20 Amp duplex, and divided equally on branch circuits, (i.e. all receptacles in the same room shall not all be on the same circuit). Minimum of 2 circuits shall be provided per room, alternating duplexes around room, with no more than four (4) receptacles on the same circuit.
 3. Each receptacle shall be clearly marked with its respective circuit number.
- B. Equipment Rack and Cabinet Electrical Requirements:
1. Equipment racks identified for electronic equipment shall have the following installed:
 - a. One (1) quad device box containing two (2) duplex 20 amp, 120VAC NEMA 5-20R-spade receptacles located on separate dedicated circuits in the room sub-power panel.
 - b. Device box shall be mounted on the backside of each rack 15-inches Above the Finished Floor (AFF). The placement of this device box and its EMT conduit shall not block or interfere with the equipment mounting area (rails) on either side of the rack.
 - c. A minimum of 24-inches of flexible conduit shall be used to attach electrical service to the equipment rack. Flexible conduit is required to prevent the shearing of the conduit during a seismic event.
 - d. Reference Division 27 11 13, Communications Cabinets, Racks, Frames and Enclosures, Fig. 31.
 2. Enclosed cabinets identified for electronic equipment shall have the following installed:
 - a. Two (2) quad device boxes containing two (2) duplex 20 amp, 120VAC NEMA 5-20R-spade receptacles to separate dedicated circuits located in the room sub-power panel.
 - b. One (1) device box shall be mounted toward the back of the cabinet near the top inside area of the cabinet to provide electrical power to the cooling fan(s). The second device box shall be located 15-inches above the floor toward the back of the cabinet.
 - c. The device boxes and EMT conduit shall not block or interfere with the equipment mounting area (inside and outside mounting rails) within the cabinet.
 - d. Reference Division 27 11 13, Communications Cabinets, Racks, Frames and Enclosures, Fig. 30.
 3. Special considerations:
 - a. ADF equipment racks and cabinets shall have 30 Amp, 120VAC NEMA 5-30R-spade receptacles in place of the 20 amp, 120VAC NEMA 5-20R-spade receptacles.
 - b. Provide a duplex 20 Amp, 240 VAC NEMA 6-20R receptacle for a DLC cabinet
- 3.05

END OF SECTION 26 27 26

SECTION 26 28 16
ENCLOSED DISCONNECT SWITCHES

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Disconnect Switches.
 - 2. Enclosures.

1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Division 1, including the following:
 - 1. Outline Drawing with Dimensions.
 - 2. Equipment Ratings.
 - a. Voltage.
 - b. Capacity.
 - c. Horsepower.
 - d. Short Circuit Withstand Rating.

1.03 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association (NEMA).
- B. Underwriters Laboratories (UL).

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric.
- B. Square D.
- C. Or Equal

2.02 DISCONNECT SWITCHES

- A. Switches shall be heavy duty type, 250-volt or 600-volt and 2 pole or 3 pole as required. Switches shall be visible blade type with quick-make, quick-break operating mechanism, full cover control circuit interlock and means for padlocking.
- B. Switches shall be fused or non-fused as required and shall be properly sized for the load. All switches shall be horsepower rated and shall always be equal to or exceed the

horsepower rating of the motor being protected. Where fusable disconnects are used 3 spare fuses must be provided to the University.

- C. Switches shall be enclosed in a NEMA 1 enclosure for interior, or a NEMA 3R enclosure for exterior. Indoor switches, in wet locations, shall be NEMA 4X.
- D. All switches using current limiting fuses shall have rejection type fuse clips.
- E. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film. The switch enclosure shall be finished in ASA-#61 light gray.

PART III - EXECUTION

3.01 INSTALLATION

- A. Install disconnects where indicated on drawings and required by governing code.
- B. Mount disconnect switches securely to building structure or equipment. Where switches are mounted to concrete or block walls, concrete anchors will be used. Switches mounted to gypsum board walls shall be secured by toggle bolts. Reinforcing channels shall be used on gypsum board walls or equipment for mounting switches.
- C. Switches shall not be supported by conduit.
- D. Comply with all applicable seismic requirements.
- E. Locate disconnect switch within sight of motor as required by the CEC.

END OF SECTION 26 28 16

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. Racks for mounting cabling and equipment (installation by construction team)
- G. Rack and Stack
- H. Plug Pack Distribution (Pre-terminated switch port cabling provided and installed by the Owner)
- I. Patch Cords and Patching
- J. Vertical Wire Managers (installation by construction team)
- K. IT UPS System (installation by construction team)
- L. PDU Power distribution Equipment

- M. VOIP Router, Voice Gateway, VOIP equipment
- N. Camera NVR/Server
- O. Overhead Paging Amplifier
- P. TV Distribution Amplifier
- Q. Closet Cleaning post production

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. Cabling Schedule
- 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. 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.
- M. 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. UC Davis Health Telecommunications Standards
- B. American National Standards Institute (ANSI)
- C. Telecommunications Industry Association (TIA)
- D. Building Industry Consulting Services International (BICSI)
- E. American Society for Testing and Materials (ASTM)
- F. Institute of Electrical and Electronic Engineers (IEEE)
- G. National Electrical Manufacturers Association (NEMA)
- H. National Fire Protection Association (NFPA)
- I. NFPA 70 National Electrical Code
- J. Underwriters Laboratories, Inc. (UL)
- K. Local Authorities Having Jurisdiction (AHJ)

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 AreaNetwork
- 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.

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. 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.
 2. Verifying proper installation of all Communications cabling. Site inspection and sign-off must be performed prior to closing-up associated accessible ceilings.
 3. 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 of 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) and by a Professional Engineer (PE) licensed in the project jurisdiction for work of this type.
- 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 Warranties 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 SB85219084FB (seismic) I SB556084XUFB (Standard) Optional eight-foot racks where applicable.
- C. Wire Managers: Panduit PEV Series full height vertical cable manager.
 - 1. Panduit PEV10 10" Wide Front/Back unless otherwise noted on plans
 - 2. Panduit PED Series dual hinged metal door installed at front face of vertical wire manage
- 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 CL6X88TGV
 - 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
- I. Copper cabling, Category 6A Shielded [JOV 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 12'.
- 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 surrounding 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.

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.

END OF SECTION

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-A-2002, 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 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

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- A. Copper ground bar, 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 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-B

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.

B. Manufacturer:

1. Panduit
2. Harger Lightning & Grounding GECLBxxx (xxx depending on cable Size)
3. Or approved equal.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 EXAMINATION AND ACCEPTANCE

- A. Review bonding configuration after all cabling and equipment is installed for approval by project IOR representative.

END OF SECTION

**SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

- 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 15 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 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

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 EXAMINATION

- A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances.
- B. 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.

3.2 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.

3.3 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. 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.

3.4 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.

3.5 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 1-114" 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 1-114" trade standard.
 - 5. Wiremold 4ffatcbs flush furniture feed poke -thru with accessories as required.
 - 6. Or approved equal.

3.6 FIRE PENETRATIONS

- A. Install UL listed fire-stop system whenever a raceway penetrates a firewall in conformance with the manufacturer's directions, the published systems assembly requirements, CBC Section 709 and 710 and CEC 300-21, whichever is the most restrictive. At cable tray penetrations, provide pillow type removable fire stop per CBC Section 709 and 710, the published systems assembly requirements and the manufacturer's directions, whichever is the most restrictive.
- B. EZ path retrofit EZDR-400 shall be provided where applicable as fire stop materials on all conduits.
- C. All communications systems cabling pathway openings in walls and floors are the responsibility of the Contractor.
- D. Install only EZ-Path products for all horizontal and vertical cabling pathway openings within TR rooms. Conduit sleeves are not acceptable.
- E. The communications conduit pathway/box 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.

END OF SECTION

SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

- 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 15 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 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

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 EXAMINATION

- A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances.
- B. 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.

3.2 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.

3.3 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. 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.

3.4 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.

3.5 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 1-114" 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 1-114" trade standard.
 - 5. Wiremold 4ffatcbs flush furniture feed poke -thru with accessories as required.
 - 6. Or approved equal.

3.6 FIRE PENETRATIONS

- A. Install UL listed fire-stop system whenever a raceway penetrates a firewall in conformance with the manufacturer's directions, the published systems assembly requirements, CBC Section 709 and 710 and CEC 300-21, whichever is the most restrictive. At cable tray penetrations, provide pillow type removable fire stop per CBC Section 709 and 710, the published systems assembly requirements and the manufacturer's directions, whichever is the most restrictive.
- B. EZ path retrofit EZDR-400 shall be provided where applicable as fire stop materials on all conduits.
- C. All communications systems cabling pathway openings in walls and floors are the responsibility of the Contractor.
- D. Install only EZ-Path products for all horizontal and vertical cabling pathway openings within TR rooms. Conduit sleeves are not acceptable.
- E. The communications conduit pathway/box 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.

END OF SECTION

SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section included cable trays in corridors and telecom spaces.

1.2 SUBMITTALS

- A. Submittal requirements:

1. Submittals are to be approved by UCD IT and consultant.
2. Provide shop drawings indicating cable tray does not to exceed 25% visually full when the project is complete. 25% full is a visual fill of 50%.
3. Provide product data for the following:
 - a. Manufacturer's data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).
 - 1) Clearly mark the provided documentation to denote which part number/specific product is being submitted.

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
- 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

1.4 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, Telecommunications Industry Association (TIA) recommended installation practices when installing communications and data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA/EIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 2. ANSI/TIA/EIA-606-C Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - 3. ANSI/J-STD-607-D Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - 4. BICSI – Telecommunications Distribution Methods Manual
 - 5. NEMA – VE-1 – Metal Cable Tray Systems
 - 6. NEMA – VE-2 – Metal Cable Tray Installation Guidelines

PART 2 - PRODUCTS

2.1 BASKET TRAY

- A. Basket Tray
 - 1. Open Wire Frame Construction.
 - 2. Welded wire mesh with continuous safety edge wire lip.
 - 3. Mesh forms grid at nominally 2" by 4"
 - 4. Electroplated zinc galvanized carbon steel.
 - 5. Accessories: Provide a complete system of accessories, including bonding and grounding connections, conduit connectors, to terminate conduits extended to basket edge, radius

shields to protect cabling at inside corners, and waterfall drop-outs at each end of cabling racks and cabinets or where needed to terminate open wiring systems.

6. Manufacturers:
 - a. Cablofil.
 - b. PW Industries.
 - c. Or approved equal.

2.2 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.

2.3 CABLE TRAY TRANSITIONS (CONTRACTOR FURNISHED AND INSTALLED)

- A. All turns, bends, and direction changes shall use manufacturer's pre-manufactured materials.

PART 3 - EXECUTION

3.1 CABLE TRAY APPLICATION

- A. Communications cable tray installations shall conform to the following:
 1. Basket Tray- Horizontal station cabling outside of the communications rooms where more than 100 cables are within the pathway.
- B. Size and Fill Ratio:
 1. Basket Tray is not to exceed 50% visually full when the project is complete. 25% full is a visual fill of 50%. Size as shown on the drawings.

3.2 INSTALLATION

- A. Each of the cable tray systems shall be installed and supported in accordance with the 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.
- C. Installation to maintain at least 12" vertical clearance over the top of each tray for use by University's personnel.
- D. Provide access 24" wide along one side of each tray unless conditions will not allow such clearances. Deviation must be cleared by IT before installing tray. Conditions of installation not approved by IT shall be replaced at no cost to the University.
- E. A minimum of 6 inches of clearance from the top of the finished ceiling to the bottom of the cable tray shall be provided.

- F. Cable distance limitation of 275 ft shall be adhered to when laying out cable support infrastructure.
- G. Cable fill ratio is not to be exceeded during the initial installation of cabling.
- H. Separation of systems other than IT are the responsibility of the contractor. IT requires a separation of all non-Ethernet protocol systems from all Ethernet protocol systems installed.
- I. Basket Tray shall not penetrate any firewall. EZ Path products shall be used as the solution with the cable or basket tray stopping short of the wall by 1 to 2 feet.
- J. Where basket tray becomes inaccessible, transition to an equivalent size conduit pathway shall be provided. If fire stopping is required at either end of the conduit(s), an EZ Path retrofit EZDR-400 shall be provided on all conduits.
- K. Center mount "T" style cable tray supports shall not be permitted.

END OF SECTION

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:
 - a. EZ-path
- J. STI Radius Control module.
 - 1. Radius Control Modules snap into the ends of EZ-path pathways and provide a minimum bend radius for IT cabling.

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.
- C. EZ-path fire rated pathways shall be installed with Radius Control Modules.

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

SECTION 27 05 43
UNDERGROUND DUCTS AND RACEWAY 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 exterior telecommunications pathways as called for in these specifications and related drawings, including but not limited to:
 - 1. Cutting and Patching Asphalt and Concrete
 - 2. Trenching and Excavation
 - 3. Underground Conduit Systems
 - 4. Cable Routing Hardware
 - 5. Horizontal Directional Drilling – Also commonly referred to as Directional Boring or Guided Horizontal Boring

1.2 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of communications equipment specified for this project.
- B. Feeder Duct-bank: Each building shall be fed via redundant diverse pathways from the nearest telecommunications maintenance hole via two (2) 4" PVC Schedule 40 conduits. Each PVC conduit shall include pull- rope. (Refer to the Telecom Site Plan for details).
- C. Innerduct: Install two (2) – 4" 3-cell flexible innerduct into each of the 4" conduits. All pull cords shall be secured at each end to prevent accidental removal.

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 OR 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 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

1.4 SUBMITTALS

- A. See Section 27 05 00 – Common Work Results for Communications, for submittal procedures.

1.5 QUALITY ASSURANCE

- A. All installation work for the new exterior telecommunications pathways shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of Owner.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval based on submittals provided.
- C. Materials and work specified herein shall comply with the applicable requirements of:
 - 1. California Electrical Code (CEC).
 - 2. IEEE/NESC – National Electrical Safety Code
 - 3. NEMA Standards including, but not limited to:
 - a. NEMA, RN1, PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - b. NEMA, TC3, PVC Fittings for use with Rigid PVC Conduit and Tubing.
 - c. NEMA, TC6, PVC and ABS Plastic Utilities Duct for Underground Installation.
 - d. NEMA, TC8, Extra Strength PVC Plastic Utilities Duct for Underground Installation.
 - e. NEMA, TC9, Fitting for ABS and OVC Plastic Utilities Duct and Fittings for Underground Installation.
 - f. NEMA, TC10, PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.
 - 4. UL Standards including, but not limited to:
 - a. UL 6, Rigid Metal Electrical Conduit

- b. UL 651 Schedule 40 and 80 PVC Conduit
 - 5. ANSI-C80.2, Specification for Rigid Steel Conduit, Enameled
 - 6. ANSI/TIA/EIA-569-E – Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 7. ANSI/TIA/EIA-607-D – Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 8. ANSI/TIA/EIA-758-B – Customer Owned Outside Plant Telecommunications Cabling Standard (including all applicable addenda)
 - 9. BICSI Telecommunications Distribution Methods Manual
 - 10. BICSI Customer-Owned Outside Plant Manual
 - D. For horizontal directional drilling, the Contractor shall follow all procedural precautions necessary to ensure that the essential aspects of proper directional bore installation are adequately controlled.
 - E. Personnel for horizontal directional drilling shall be fully trained in safety and their respective duties as part of the directional drilling crew.
- 1.6 WARRANTY
- A. See Section 27 05 00 – Common Work Results for Communications, for additional warranty requirements.

PART 2 - PRODUCTS

2.1 CONDUIT SYSTEM

- A. Non-Metallic Conduit:
 - 1. PVC plastic pipe, ASTM D1785, Schedule 40, Type PVC 1120.
 - 2. Tone Tape, Arnco DL WP12LC Tone Tape, or equivalent.
- B. Conduit Joint Couplings:
 - 1. PVC non-metallic fittings must be installed with solvent applied couplings.
 - 2. An approved transition coupling shall be used to connect metal to plastic (PVC) conduits.
 - 3. Couplings may be threaded and / or glued to provide watertight seal at conduit junctions.
- C. Electrical Metallic Tubing (EMT): Electro-galvanized steel tubing 3/4" and larger diameter per project requirements.
 - 1. Conduit joint couplings and connectors: steel double set screw indenter fittings.
 - 2. Metal bushings for 3/4" and 1" conduit.
 - 3. Insulated metallic bushings for 1-1/4" and larger conduit.
 - 4. Insulated metallic bushings with grounding lugs as required.
 - 5. Conduit sweeps: minimum 10 times the conduit inside diameter.
 - 6. Include required conduit straps, and hangers, heavy-duty malleable iron or steel. Perforated pipe strap or wire hangers are not permitted.

- D. Outside Pull-Box: Minimum 14 gauge galvanized steel with weatherproof locking cover and hardware for surface mounting as required for project. Dimensions as required for project.
- E. Test mandrel shall be ¼" smaller than inside conduit diameter and not less than 12 inches long.
- F. Pull-rope: 1/4" Nylon pull rope.
- G. Core Drill Seals for Outside Building Walls: Link-Seal waterproof assembly or equal. Manufactured by PSI/Thunderline/Link-Seal.
- H. Conduit Caulking Compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.
- I. Underground Plastic Line marker: Manufacturer's standard permanent, continuous-printed polyethylene film tape with metallic core, intended for direct burial service; not less than 3" wide x 4 mils thick. Provide orange tape with black printing reading, "CAUTION TELEPHONE/DATA CABLE BELOW," or similar.
- J. Ground Wire: Bare Copper # 6
- K. Tracer Box: NEMA-3 4" x 4" weatherproof box
- L. Spacers for 4" Conduit: Carlon S289NJN Intermediate Spacer and S288NJN Base Spacer
- M. Precast Concrete Vault:
 - 1. General: Provide precast concrete communications vault as detailed on the Drawings and as required for installation of new duct-bank systems and connection to existing duct-bank systems at locations shown on the Drawings. Provide 4'W x 6'L x 4'D precast.
 - a. Design: Vaults shall be steel reinforced, and the complete vault assembly shall be designed for H-20-44 bridge loading. Submittals shall clearly indicate all dimensions and reinforcing steel.
 - 2. Concrete: Vaults shall be constructed using concrete with a 4500 psi 28-day strength. Concrete mix shall be designed in accordance with ASTM standards.
 - a. Reinforcing Steel: Steel shall be intermediate or hard grade billet steel conforming to ASTM A15, deformed in accordance with ASTM A305.
 - 3. Vaults: Vault and pull box covers for all non-traffic areas shall be made of ductile iron cover, covers in parking and traffic areas shall be cast iron and rated for heavy vehicular traffic. Mount covers in a 30" Type "B" or "WRM" frame. The frame and neck shall be doweled into the vault to prevent movement away from the opening. Voice and Data communications vaults and pull box covers shall be marked "TELECOMMUNICATIONS".
 - 4. Conduit Entry: Plastic conduits shall include a bell end inside the vault or pull box, mounted flush and grouted to seal openings. Precast fiber type terminators shall be provided for each duct-bank entry.
 - a. Grounding: A #4/0 bare copper ground wire shall penetrate the side wall in the bottom section of each vault and pull box and extend 48" inside and outside of the vault pull box.

5. Accessories: Knockouts, cable racks, sumps, steps, joint seals and other accessories shown on the Drawings or required for a complete installation shall be provided.
- N. Duct Plug 4": General Machine Products (GMP) 6668R16
- O. End Bell 4": Carlon E297N
- P. Squeegee is moistened pea-sized gravel and sand mixture.
- Q. Multi-cell Fabric Mesh Duct:
 1. All fabric mesh duct shall be installed per manufacturer's requirements.
 2. Only manufacturer's fittings, transition adapters, terminators, accessories and installation kits shall be used.
 3. All fabric mesh duct shall be populated with a measured pull tape.
 4. Manufacturer: MaxCell.

2.2 CABLE ROUTING HARDWARE

- A. Cable Rack with Support Hardware as Required (or comparable):
 1. 18 Hole: Condux 08380200, Chance C203-1126
 2. Other Sizes as Required: Condux, Chance
- B. Cable Rack Steps/Hooks:
 1. 4": Condux 08380600, Chance C203-1131
 2. Other Sizes as Required: Condux, Chance
- C. "S" Rack Supports: Condux, Chance
- D. Step Lock Wedge: Panduit CHW-C20

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the new exterior telecommunications pathways are to be installed. Provide notification, in writing, of conditions detrimental to proper completion of the work.
- B. Verify field measurements and pathway routing conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.
- C. Beginning of telecommunications pathway installation indicates Contractor acceptance of existing conditions.

3.2 EXCAVATING, TRENCHING AND BACKFILLING

- A. General: The work hereunder includes whatever excavating and backfilling is necessary to install the voice and data communications work. Coordinate the voice and data communications work with other work in the same area, including excavating and backfilling, dewatering, floor protection

provisions, other temporary facilities, other underground services (existing and new), landscape development, paving, structural foundations, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.

- B. Standards: Except as otherwise indicated, comply with the applicable provisions for voice and data communications work excavating and backfilling. Refer instances of uncertainty to the Architect/ Engineer for resolution before proceeding with the Work.
- C. Coordinate excavating, trenching and backfilling with Landscaping, Civil, Mechanical, Plumbing and Electrical drawings. Voice and Data Communications duct-banks shall be independent of any other systems.
- D. Refer to Civil contract documents for information regarding required depths, slope and grade and additional information regarding trenches. Where these documents and the civil documents differ, bring any such differences to the attention of the engineer prior to construction. The bottom of the trench shall be accurately excavated to provide firm, uniform bearing for the bottom of the raceways and duct-banks. Where mud or unstable soil is encountered in bottom of trench, it shall be removed to firm bearing and the trench shall be backfilled with bedding sand to proper grade and tamped to provide uniform firm support.
- E. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the conduit on undisturbed soil or 2" of sand fill at every point along its entire length. In general, grading for voice and data communications duct-banks and conduits shall be from building to vault, and from a high point between vaults to each vault.
- F. Exercise care not to excavate below required depth, leaving a flat bed of undisturbed earth, firm and secure, before laying conduit. In the event rock is encountered, excavate 6" below required depth and backfill to required depth with bedding sand, and compact to minimum 95% compaction.
- G. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the site and properly disposed of.
- H. The Contractor shall be fully responsible for the safety of persons, materials and equipment in or near trenches or other excavations and provide all required sloping, shoring, railings and other protective provisions. The Contractor shall provide a trench shoring plan and design which is sealed by a registered professional engineer. Refer to Divisions 1 and 2 for additional requirements.
- I. If any unknown and/or uncharted utilities are encountered during excavation, promptly notify Architect/ Engineer and wait for his instructions before proceeding.
- J. If such unknown utilities are encountered and work is continued without contacting the Architect/ Engineer for instructions, and damage is caused to said utilities, the Contractor shall repair at his own expense, such damage to the satisfaction of the owner or utility company concerned.
- K. Trenches shall not be backfilled until all required tests have been made by the Contractor and approved by the Architect/Engineer and any local authorities having jurisdiction.

- L. Backfill shall be cement stabilized sand up to 6" above the top of conduit or duct-bank as required by code. Backfill up to grade shall be in maximum 6" lifts with minimum 95% compaction of lifts. Refer to Division 2 or elsewhere in Contract Documents for additional trenching and backfill requirements.
- M. Opening and Re-closing Pavement, Landscape Areas and Lawns: Where excavation requires the opening of existing walks, street, drives, other existing pavement or lawns, such surfaces shall be cut as required to install new conduit and to make new connections to existing conduits. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched or replaced, using materials to match those cut out or removed. Patches shall thoroughly bond with the original surfaces, shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas. All removed work shall be replaced by craftsman who regularly installs the types of work being replaced.
- N. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5' to prevent damage from the construction operations and/or equipment. All excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb radius shall be brought to the attention of the Architect before they are cut or damaged in any way. The Architect will give immediate instructions for the disposition of same. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18" from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.
- O. Perform all trenching and backfill for new underground conduit system placement as shown on the project drawings.
- P. Perform pavement marking as required. All utilities to be located by contractor and exposed, if necessary, prior to construction.

3.3 CONDUIT SYSTEM PLACEMENT

- A. Place new conduit system including maintenance holes as shown on the project drawings.
- B. Twelve-inch (12") clearance from all utilities to be maintained. If not possible, conduit to be encased in concrete slurry (flow fill) where proper distance cannot be obtained.
- C. Cross telecommunications conduit ducts below gas piping.
- D. All conduits shall be thoroughly cleaned before laying or using.
- E. During construction, the ends of the conduits shall be plugged to prevent water washing mud into the conduits, vaults, or buildings. Specific conduit care shall be taken to keep the conduits clean of concrete, dirt or any other substance during the course of construction.
- F. New and reopened trenches under asphalt roadways and parking lots must have concrete cap or be encased in concrete as required.

- G. Support multiple conduits on preformed nonmetallic separators to provide not less than 1" spacing between exterior surfaces of conduit (Type 5). Spacing between separators shall be close enough to prevent sagging of conduits or breaking of couplings and watertight seals.
- H. Squeegee is to be placed in the trench for 20' on each side of the vaults (Type 4).
- I. Conduits shall be securely anchored in place with nylon tie-downs to prevent movement during the placement of concrete slurry (flow fill), squeegee, and other backfill materials. Wire tie-downs are prohibited.
- J. Seal all conduit junctions and fittings watertight prior to pour of concrete slurry (flow fill). Conduit couplings shall be made in accordance with the manufacturer's recommendation for the particular type of conduit and coupling selected and as approved.
- K. Unless otherwise noted on drawings, a minimum two-foot (24") depth of cover is required above the top of all conduits.
- L. Provide communication drain box in conduit six feet (6') from building outside wall penetrations as shown in project drawings. Conduit inside drain box shall be perforated to allow water and gas to escape.
- M. Transition to PVC coated GRC conduit five feet (5') from building outside wall penetrations.
- N. For all offsets and sweep bends, provide fiberglass or PVC coated GRC.
- O. All conduit bends are to be minimum 3' radius or larger as noted on drawings.
- P. Bury underground plastic line marker one foot (12") above the telecommunications conduit.
- Q. Cast into concrete a #6 bare copper ground wire directly above the telecommunications conduit and extend 4" into each vault space. Extend 6" of tracer wire into tracer box on outside wall of building directly above conduit entry point.
- R. Provide plastic conduit bell ends at each PVC conduit termination and for all conduit entering vaults.
- S. Do not bore under concrete sidewalks, remove and replace sidewalks as necessary.
- T. The new conduit shall extend through the wall into the building, tunnel, or crawl space a minimum of 4 inches.
- U. Building, tunnel, and vault core drills must be sealed around conduits with approved waterproof plugging compound.
 - 1. Seal openings around conduits that pass through inside building wall core drills with UL listed foamed silicone elastomeric compound.
 - 2. Seal openings around conduits that pass through outside building walls with a complete Link-Seal assembly or equal for a waterproof seal. Slope conduit away from building.
 - 3. Seal openings around conduits that pass through vault walls with foundation foam on the interior of the core and silicone sealer on the inside and outside of the core for a waterproof seal.

- V. Maintenance Holes (MH) shall be placed with the long dimension in line with the main conduit run. The conduit shall enter opposite ends of the MH on the short sides so that the MH shall not be used as a 90 degree bend in cable installations.
- W. The ends of the metallic conduit shall be reamed and bushed using:
 - 1. Insulated metallic bushings for 1-1/4" conduit and larger
 - 2. Insulated metallic bushings with grounding lugs for conduit entering TRs and ERs
- X. After conduit duct installation has been completed and concrete has set, pull "D" test mandrel through all new conduit ducts to verify duct integrity and ensure smooth interior surfaces free from burrs or obstructions that might damage cable sheaths.
- Y. Following mandrel testing, draw cylindrical wire brush with stiff bristles through each conduit to clean the conduit and remove any concrete, dirt or other obstructions.
- Z. Stub out conduits into ERs, TRs, and cabinets only enough to attach connector and bushings with grounding lugs except conduits shall rise a minimum of 6 inches above the finished floor.
- AA. Install new pull rope in all new conduit and extending three feet into each building space.
- BB. Plug ends of the new conduit with watertight rubber conduit plugs, conduit caulking compound, or conduit caps to ensure foreign matter does not enter the buildings.
- CC. Refer to Owner prior to cutting or drilling any surface.

3.4 CABLE ROUTING HARDWARE

- A. Place new cable routing hardware in the tunnels and in crawl spaces beneath the building as required for the project and as shown on the drawings.
- B. Perform installation of routing hardware as specified in Section 270526 including anchoring and supports, grounding and bonding, etc.
- C. Place new ladder, pulling-in irons, cable racks, "S" rack supports, steps in new and existing vaults as required for backbone cable routing.

3.5 HORIZONTAL DIRECTIONAL DRILLING

- A. Owner shall be notified 48 hours in advance of starting horizontal directional drilling work. The directional drilling shall not begin until Owner is present at the job site and agrees that proper preparations for the operation have been made.
- B. No work shall commence until Traffic Control and Construction Permits from Owner and/or the City are in place as applicable for the specific project.
- C. Site Preparation
 - 1. Prior to any alterations to work site, the entry and exit points shall be marked.
 - 2. No alterations to the work site beyond what is required for operations shall be made.
 - 3. All activities shall be confined to designated work areas.
- D. Drill Path Survey

1. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings.
 2. If a magnetic guidance system is being used, the drill path will be surveyed for any surface geomagnetic variations or anomalies.
- E. All applicable environmental regulations shall be adhered to.
- F. Following drilling operations, the equipment will be de-mobilized and the worksite restored to its original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original site conditions.

3.6 SAFETY

- A. The contractor must comply with Owner regulations for asbestos, lead, and confined spaces.
- B. All applicable state, federal and local safety regulations shall be adhered to and all operations shall be conducted in a safe manner.
- C. Guard vault openings per NESC C-2-2017, 423.A:
1. When covers of maintenance holes are removed, the opening shall be promptly protected with a barrier, temporary cover, or other suitable guard.
- D. Test for gas in vaults and unventilated vaults per NESC C2-2017, 423.B and C, including, but not limited to:
1. The atmosphere shall be tested for combustible or flammable gases before entry.
 2. Where combustible or flammable gases are detected, the work area shall be ventilated and made safe before entry.
 3. Unless forced continuous ventilation is provided, a test shall also be made for oxygen deficiency.
 4. Provision shall be made for adequate continuous supply of air. Note: The term adequate includes evaluation of both the quantity and quality of the air.
 5. Employees shall not smoke in vaults.
 6. Where open flames must be used in maintenance holes or vaults, extra precautions shall be taken to ensure adequate ventilation.

3.7 AS-BUILT DRAWINGS

- A. Mark the project drawings with notations reflecting any variations from the base specifications and drawings including as-built conduit routing.

END OF SECTION

SECTION 27 05 53
IDENTIFICATION FOR 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 clear
- 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.

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
- 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 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. Where insert type labels are used on Copper Patch Panels, provide clear plastic cover over label.
- B. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- C. Shall be preprinted or computer printed type. Handwritten labels are not acceptable.
- D. Location ID:

1. Panduit - White C061X030FJC
2. Panduit - White C750XOSOYIJ
3. Or approved equal.

E. Non-keystone-based fiber patch panels:

1. Panduit - White C061X030FJC
2. Panduit - White C750XOSOYIJ
3. or approved equal.

F. 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

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

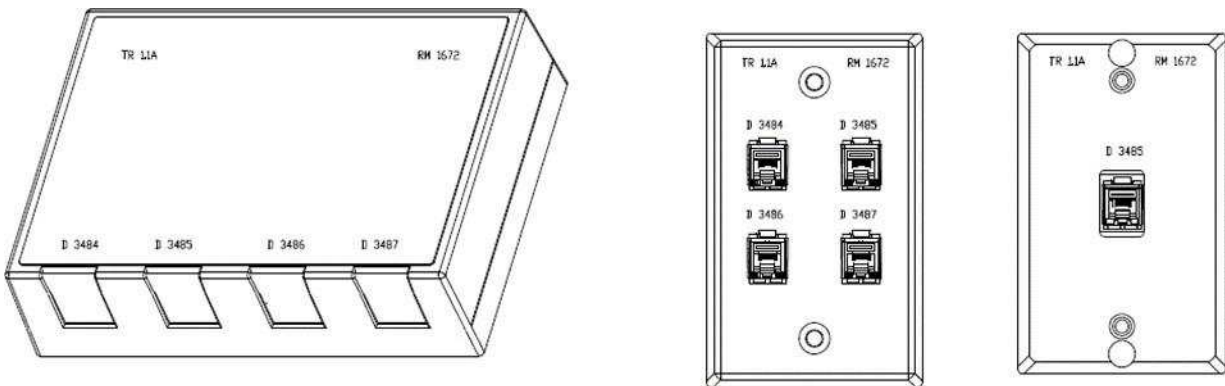
1. Label the pair count at the top of the patch panel, separated from all others.
2. Place the cable's identification text centered on the top label strip. (example: 18CA75, TIE 1672A).

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. RXL-2823-BK8019 heavy duty double sided seismic 2-post rack, or equal.
 - 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. RXL-2200-BK80T, RXL-2020-BK80T two post rack, or equal.
 - 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

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
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- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
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- 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. Provide fusion splice to factory terminated and pigtailed splice cassette.
 2. Insertion loss for multi-mode ≤ 0.15 dB - manufacturer's rating for typical splice.

3. Insertion loss for single mode ≤ 0.06 dB - manufacturer's rating for typical splice.
4. LC at rack mounted patch panels as noted or scheduled,
5. 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 Ascend high density rack mounted fiber housing with LC cassettes 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. _____ Project Name and Number

- 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
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PART 2 - PRODUCTS

2.1 LADDER RACK

A. Cable Runway (Ladder Rack)

1. Construction:
 - a. Solid steel side bar per ASTM A-36 or tubular steel side bar per ASTM A-513.
 - b. Stringers shall be 1-1/2" x 3/8" x .065".
 - c. Cross members shall be 1/2" x 1" x .065" welded at 9" intervals.
 - d. Overall length shall be 9' 8-1/2".
 - e. UL classified
2. Accessories: Provide with a complete system of accessories, including radius corners at vertical and horizontal bends, section splice plates, expansion plates, blind-end plates, etc. Provide waterfall drop-outs at each end of cabling racks and cabinets or where needed to terminate open wiring systems.
3. Finish: Black powder coat
4. Runway shall be black in color minimum 18" wide.
5. Provide runway elevation kit.
6. Modular ladder rack, such as Panduit Redi-Rail, is not approved for use on UCDH projects.

2.2 LADDER RACK APPLICATION

1. Ladder Rack - Wraps and traverses within communications rooms, as shown on construction drawings.
2. Ladder Rack size is typically 18" wide unless the room size prohibits access when installed. Install ladder rack as sized on the drawings.

2.3 BACKBOARD CABLE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

- A. 3/4 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.

2.4 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.

2.5 CONDUIT SPILLWAY (CONTRACTOR FURNISHED AND INSTALLED)

- A. For conduit transitions.
- B. Constructed of fire-retardant ABS.
 1. Panduit CWF400 or equal.

2.6 LADDER RACK WATERFALL (CONTRACTOR FURNISHED AND INSTALLED)

- A. Provide ladder rack 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).

2.7 J HOOK CABLE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

- A. Provide and install according to Section 27 05 29.

2.8 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.

2.9 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.
- C. Provide Panduit PE2VD1096PT/N or equal.

PART 3 - EXECUTION

3.1 GENERAL EXECUTION - PREPARATION

- A. UCDH 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 INSTALLATION

- A. Do NOT Tie Wrap cables.
- B. Ladder rack shall be securely bonded to the Telecommunications Grounding Busbar (TGB and TMGB). Attach a bonding conductor sized as defined in J-STD-607-D and as defined by local code or the authority having jurisdiction (AHJ) between the Telecommunications Grounding Busbar and the ladder rack. Attach the bonding conductor to the ladder rack using included hardware according to the manufacturer's installation instructions. The installer shall provide the bonding conductor and other necessary hardware required to make the connections between the ladder rack and the Telecommunications Grounding Busbar.
- C. Install end caps for all exposed ends. File and deburr ladder rack then place end caps on all exposed ends.

3.3 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.

3.4 EXAMINATION AND ACCEPTANCE

- A. Perform walk thru with Owner representative to validate cable separation, cable routes and fill ratios.

END OF SECTION

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
 - 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 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 remote 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
- 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 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 0.50 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 AFL Ascend LC fiber cassette.
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 performed using an Optical Loss Test Set 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 IIIe field testers as defined in TIA-1152 – Fluke DSX-5000, or equal. Test equipment shall have been calibrated within 1 year of test date.
 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 1 year of the test date.
 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 $\leq 50\text{nm}$ for 850nm wavelengths and $\leq 140\text{nm}$ for 1300nm wavelengths.
4. Output Stability $\pm 0.40\text{ dB}$ from 0 to 50 degrees C
5. Long Term output stability $\pm 0.10\text{dB}$ 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 $\pm 20\text{ nm}$ wavelength laser light sources.
3. Output Stability $\pm 0.40\text{ dB}$ from 0 to 50 degrees C
4. Long Term output stability $\pm 0.10\text{dB}$ at 25 degrees C Measurement range shall be from 10 to -60 dBm
5. Accuracy shall be $\pm 5\%$ at 0 to -50dBm and $\pm 10\%$ 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 UCDH IT will be required to allow for an exception of a test result.
4. 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 13 43
COMMUNICATIONS SERVICES CABLING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Outdoor (Outside Plant) Communications Cabling placed underground in existing communications ducts.
 - 1. High pair count copper cabling
 - 2. Fiber Optic Cabling
 - 3. Terminate fiber on patch panels as specified in Section 27 11 19
 - 4. Terminate copper cabling on lightning protectors as specified in Section 27 05 00
- B. For all cabling
 - 1. Test cabling to demonstrate performance to specified standards or better using test equipment and methods as specified in Section 27 05 00.
 - 2. Label cables, jacks, plates, and patch panels as specified in Section 27 05 53.
 - 3. Document on Record Documents as described in Section 27 05 00.

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 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 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 REFERENCES

- A. In addition to the requirements of Section 27 05 00 - Common Work Results for Communications, conform to the applicable portions of the following standards agencies:
 - 1. BICSI
 - 2. Customer Owned Outside Plant Design Manual, Latest Edition.

1.4 SUBMITTALS

- A. All submittals shall be approved by IT Facilities.

1.5 SEQUENCING

- A. Complete entrance facilities prior to need for communications to fire life safety.
- B. Complete Section 27 13 00 to facilitate need for communications to fire life safety.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLING

- A. As specified in Section 27 00 50 – Common Work Results for Communications
- B. Fiber Optic Cable, Outside Plant:
 - 1. AFL
 - 2. Corning
 - 3. Approved Equal
- C. Drawing References:
 - 1. F-XXX Multimode, where XX indicates fiber count.
 - 2. F-XXX Singlemode, where XX indicates fiber count.
 - 3. Contact Owner Representative for next sequenced designation number.
 - 4. Contact Owner Representative for underground plant MAP.
- D. Refer additionally to Fiber Cable Construction, General, and elsewhere herein.
 - 1. Adhere to TIA-455 or TIA-568c.3 or applicable.

- E. Suitable and approved for wet location/direct burial.
- F. Ribbon fiber bundles
 - 1. Armored/rodent resistant or similar construction
 - 2. AFL part # DNT-0019-04 WTC SWR OSP, (XXX) (strand count) or
 - 3. SM SR15E-(XXX)-K-C-(XXX)-1-00N1D
- G. Performance:
 - 1. Maximum attenuation per EIA/TIA-455-61
 - 2. Multimode
 - 3. 850 nm: ≤ 3.5 dB/km
 - 4. 1300 nm: ≤ 1.0 dB/km
 - 5. Singlemode
 - 6. 1300 nm: ≤ 0.4 dB/km
 - 7. 1550 nm: ≤ 0.3 dB/km
- H. Maximum required bend radius:
 - 1. At installation: 20x's diameter
 - 2. Long term application: 10x's diameter
 - 3. Zero water entry per FOTP-82, 24 hours immersion
 - 4. Crush resistance: 600N/cm min per EIA-455-41
 - 5. Impact Resistance: 25 impacts, per FOTP-25
 - 6. Flex, Twist/Bend: 25 cycles, per FOTP-104 and FOTP-85
- I. Loose Tube Manufacturer:
 - 1. General Cable
 - 2. AFL
 - 3. Approved Equal

2.2 OPTICAL FIBER SPLICE CLOSURE

- A. Functions/Features
 - 1. Provide re-enterable underground or inside plant splice closure as shown on the Drawings.
 - 2. Metal Stainless Steel or plastic construction – no corrodible materials.
 - 3. Waterproof, suitable for direct burial.
 - 4. Fusion splice protection chamber.
 - 5. Grommet cable entrance and exits.
- B. Manufacturers
 - 1. Preformed Line Products Coyote Series.
 - 2. AFL Apex.

3. Or approved equal.

2.3 TELEPHONE, OUTSIDE PLANT, UNDERGROUND IN DUCTBANK

- A. Drawing Reference: xx CU, with pair counts and Building Termination as indicated.
- B. Features/Functions
 1. Solid round copper wire individually bound per REA PE-39 color coded.
 2. Meets RUS REA 1755.390.
 3. Solid aluminum tape overall shield.
 4. Gel filled.
 5. Polyethylene Overall Jacket.
 6. Suitable for direct burial.
 7. 6 to 3000 Pair counts available.
- C. Manufacturer
 1. General Cable
 2. Any meeting REA PE-39 for cable smaller than 400 pair.
 3. Any meeting REA PE-39 or REA PE-89 for cable 400 pair or larger.
 4. Or approved equal.

2.4 OUTSIDE PLANT HORIZONTAL CABLING

1. General Cable GenSPEED 10 UTP Indoor-Outdoor Plenum Category 6A Cable, Part No. 7141007.
2. Or approved equal.

2.5 SHIELD CONNECTORS

- A. Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire.
- B. The connector shall be made of tin-plated tempered brass.
- C. Shield bond connectors shall comply with REA PE-33.

2.6 GROUNDING BRAID

- A. Grounding braid shall provide low electrical impedance connections for dependable shield bonding.
- B. The braid shall be made from flat tin-plated copper.

2.7 OUTSIDE PLANT TELEPHONE CABLING CLOSURES

- A. In Building Telephone Closure:
- B. Drawing Reference: IBTC

C. Features and Functions:

1. Provides transition point from unlisted, gel-filled Outside Plant Cabling to Interior (CU) cabling.
2. Can house a straight, butt, and branch splice in a protective housing.
3. Not pressurized or encapsulated.
4. Fire-retardant Plastic construction, meeting PUB55006 for interior (in-building) installation.

D. End Caps

1. Multiple End caps shall be sized precisely to fit the diameter of the tip cables entering the closure.
2. Number of openings in the multiple end caps shall be determined by dividing the number pairs in the feed cable by 100 and doubling that number. (ie. 1200 pair cable would have 24 openings for tip cables.
3. Collared Cap opening can be up to 6.35mm (1/4") larger than the feed cable diameter.
4. Actual end cap to be provided shall be based on the diameter of the feed cable to be spliced.

E. Plugs

1. Use tapered or collared plugs as required to fill extra opening in end caps.
2. Seal if inside diameter of hole is less than 6.35mm (.25").

F. Bushings

1. Use rubber or variable bushings as required to reduce standard opening in end caps to accommodate custom diameters.
2. Seal if inside diameter of hole is less than 6.35mm (.25").

G. Manufacturer

1. UraSeal 2000FR Type.
2. 3M K&B Series.
3. Tyco Electronics.
4. Or approved equal.

2.8 OUTSIDE PLANT TELEPHONE CLOSURE, VAULT

A. Drawing Reference: OTC, TOSC

B. Features/Functions

1. Stainless Steel outer jacket housing
2. Can house a straight, butt, and branch splice in a protective housing.
3. Rigid outer protective body
4. Suitable for periodic water immersion - air and watertight.
5. Renter able.
6. Gel Filled, Injected encapsulant using precision means.
7. Minimum inside diameter shall be 5" (127mm).

8. Minimum inside length shall be 26" (660mm).

C. Manufacturer

1. Preformed Line Products Armadillo Stainless.
2. UraSeal
3. 3M
4. Emerson Network Power
5. Or approved equal.

2.9 MULTIPAIR SPLICING CONNECTORS

- A. Drawing Reference: None. Provide at all IBTC, TOSC, OTC and similar locations where shown on the plans or required in the field.

B. Function

1. Can provide gas tight termination for large pair counts of copper cabling to connectorized ends and reliable mate ends in compact area.
2. Industry standard termination means.
3. All modules shall have test entry ports on the front side of the module.
4. All straight splicing modules shall be tap modules.

C. Manufacturer

1. 3M 710 (Industry standard item).
2. Or approved equal as required to match the standard used at the facility.

2.10 MISCELLANEOUS UNDERGROUND PRODUCTS

A. Encapsulant

1. Encapsulates shall be transparent.
2. Splice case and Encapsulant must be re-enterable.
3. Shall be compatible with the cable insulation.
4. Shall not be corrosive to copper and must not support fungi or mold growth.

2.11 WATER IMPERMEABLE CONDUIT PLUGS

1. Tyco RDSS Duct seal / E7512-160 / E7512-160.
2. Jack moon compression plugs.
3. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide safety barriers and flag persons for all open manholes and pull-boxes that are located in areas accessible to the public.

- B. Provide traffic control in accordance with the requirements of Campus policies and standards. Conform to OSHA guidelines when accessing manholes and handholes, inclusive of the requirement for air sampling. Provide continuous measurements. Provide the Owner's Representative with contractor-maintained logs of air samples taken at most two hours apart.
- C. Provide sufficient personnel to permit one individual to remain above the surface at all times, in visual contact with persons in manholes and similar. Provide the observer with an appropriate means of obtaining assistance.
- D. Provide ladders for access to manholes. Do not permit workers to use cables or splice cases as ladders.
- E. Install a $\frac{3}{4}$ ", 2500lb rated, mule tape with detectable tracer wire and sequential footage markers.

3.2 CABLE PULLING

- A. Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.
- B. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.
- C. OSP Copper Cabling Special Procedures
 1. Contractor shall provide notice 2 days in advance notice prior to pulling any cable greater than 400 pairs in size or when a winch is planned for use.
 2. Owner's representative shall have the option to be present to observe all pulling activities of cable greater than 400 pair or when a winch is planned for use.
 3. Contractor shall be responsible for verifying that ducts are ready for occupancy prior to cable placement.
 4. Contractor shall assume responsibility for any difficulties or damage to the cable during placement.
 5. Adhere to all manufacturers requirements regarding pulling tension allowable lubricants and bending radius.
 6. All un-terminated cable pair ends must be cleared (not shorted or crossed) and binder tagged.
 7. All open-ended cables must be watertight sealed using temporary end caps or encapsulation.

3.3 CABLES IN MANHOLES, PULL BOXES AND HANDHOLES

- A. Support cable splices in underground structures by racks on each side of the splice.
- B. 100 ft of slack shall be installed (in aggregate) at one or more maintenance vaults to accommodate possible service outage and cable repairs.
- C. Wrap each vault when passing thru each Maintenance Hole.
- D. Install cables at middle and bottom of cable racks, leaving top space opening for future cables, except as otherwise indicated for existing installations.

3.4 BUILDING ENTRANCE CONDUIT WATER BARRIER

- A. Conduits entering a structure are to penetrate the last vault at the highest elevation possible to prevent water penetration.
- B. All Conduits entering a structure are to be sealed and watertight from the last vault to the MPOE, TR or ER.
- C. NO conduits shall be sealed (other than fire stopping materials required by the AHJ) inside the structure.

3.5 SERVICE LOOP AND TRANSITION SPLICE AT BUILDING ENTRY

- A. For outside plant, flooded cables of 100 pair or greater entering a Building Distribution Facility or Entrance Facility, provide a transition in a splice case, Type IBTC, to non-flooded cable prior to termination on the protector blocks. Unless otherwise indicated on the plans, position the splice case high on the backboard, parallel to the floor at location suitable for service and where gel will not be drawn from the serving outside plant cabling into the IBTC.
- B. At Telecommunications Rooms, at both ends of cables, provide at least 20 feet of cable in excess of that required to reach the protectors or terminal block by. Form into a storage loop and mount to wall using a loop ring as directed by the Owner's Representative.
- C. Bonding Harnesses shall be used to ground the shields of the spliced cables to the TGB or building service ground. Bonding harness shall be 14 AWG and sized according to closure.
- D. Refer to Section 27 13 00 – Communications Backbone Cabling for additional requirements for termination within Telecommunications Rooms.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provisioning, installation, termination, and testing and 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.
- 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 CL6X88TGV
 - 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

2.3 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 w/ 8P8C 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, unspliced 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. Service loop at ALL TERMINATIONS

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.
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 station 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

SECTION 27 41 33
MASTER ANTENNA TELEVISION 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 the distribution of the TV signal to patient rooms, lobbies, conference rooms, and the display devices used as described in this Section, including but not limited to:
 - 1. All MATV Video Distribution Equipment and Cabling including but not limited to:
 - a. Coax
 - b. Fiber
 - c. Terminations
 - d. Wall plates
- B. Related Work: Equipment and materials provided and installed by others, and require coordination with the work of this Section, shall include the following:
 - 1. Conduits and back-boxes
 - 2. 120v, 60Hz AV Outlets

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- D. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- E. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

1.3 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections
- B. The Video Cabling System will be used for distribution of local MATV (Master Antenna TV system), satellite, and on demand, pre-recorded programming.
- C. Each end device will be fed with a single quad-shielded coaxial cable with appropriate code compliant outer jacketing, one per outlet. ("Home Run")
- D. The Video Cabling System will be able to achieve bi-directional signals, two-way communication over a single coaxial cable, using different frequency bands carrying signals in opposite directions.
- E. An electronic receiving device (End Device) will provide a video for display.

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, published 2008, plus errata issued in October 2008.
- B. National Fire Protection Association
 - 1. NFPA 101, Chapter 8 for firestopping in healthcare facilities
- C. National Electrical Manufacturer's Association (NEMA)
- D. BICSI Telecommunications Distribution Methods Manual, 14th Edition (2020)
- E. American National Standards Institute (ANSI)
- F. California Electrical Code (CEC), 2019
- G. California Building Code Title 22 (Accessibility) and Title 24, Part 6 – California Energy Code

1.5 SUBMITTALS

- A. Conform with the Division 1 33 00 Submittal Procedures:
- B. Shop Drawings: Submit in accordance with Division 1 requirements. Including the following:
 - 1. Any Changes in functional block diagrams showing all equipment, connections, tap values and calculated dBmv levels.
 - 2. Shop drawings: provide a complete set of drawings and with as-built drawings information prior to final acceptance. These drawings shall contain outlet designations and any changes made to the system during installation. The as-built drawings shall be provided as required by Division 1.
 - 3. Complete riser diagrams showing all devices, tap values, calculated dBmv levels and cabling as installed.
 - 4. Descriptions of all equipment and normal operating procedures and channel assignments
- C. Warranty Documentation: Provide one (1) copy containing all warranty information required by manufacturers for submission of warranty claims for all equipment installed. Comply with Division 1 requirements.
- D. Technical Documentation: Furnish one (1) complete copy technical service manual.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Installer shall have at least three (3) years' experience in the installation of similar systems.
- C. Licensed to install low voltage electronic cabling systems in the State of California where applicable (C7).
- D. Provide a 1-year warranty on materials and installation.

- E. Provide a 1-year warranty on all electronics provided.

PART 2 - PRODUCTS

2.1 DEVICES

A. General

1. Contractor shall be prepared to receive and deliver materials listed below from 7301 14th Ave. Supports to be sized to suit load and selected to match mounting conditions.
2. Owner Provided Contractor Installed (OFCI):
 - a. Optical Amplifier
 - b. Optical Receiver
 - c. TV
 - d. TV bracket mount
 - e. CommScope Coax or approved equal

B. Manufacturers

1. CommScope Coax or approved equal
2. CommScope Multimode Fiber or approved equal

C. Spare Parts

1. Installation packages should include one TV per 15 installed as a spare, or as determined by UCDH representative.
2. Installation packages should include one TV bracket mount per project as a spare, as determined by UCDH representative.
3. Installation packages should include one Optical Receiver per project as a spare, as determined by UCDH representative.
4. Installation packages should include one Optical Amplifier as a spare, as determined by UCDH representative.
5. Deliver Spare parts and obtain a receipt for spare parts from UCDH representative.
6. Additional spare parts shall be determined by project and by UCDH representative.

PART 3 - EXECUTION

3.1 GENERAL

- A. Backboards: Telecommunications Room (TR) used for TV distribution will have a fire-resistant backing board provided and used to mount video system equipment. This area of installation will include a designated 20-amp, 120 Volt AC quad circuit minimally.
- B. All fiber connectors shall be SC/APC polished connector. Fiber requires both a transmitter and receiver to replace a hardline ½" RG-11 trunk feed.

- C. Cable Connectors: Furnish and install RF connectors for RG6 and RG11 cable for use with radiation proof passives or as directed by UCDH standards. Quantities as required. Holland Electronics SLEV or Beldon PPC style compression fittings.
- D. RG6 to RG11 Transitions: Provide sufficient adaptors for all transitions from RG6 to RG11 cable runs.
- E. Furnish grommets in wire mold, outlet boxes, and communications pathways as required to prevent damage to insulation or conductors.
- F. Secure all cabling to avoid damage to cabling and shielding. Manufacturer's recommended pulling tensions and bend radius shall not be exceeded.
- G. In the Telecommunications Room (TR) furnish Cable Distribution Rings (D-Rings) as necessary to route and support cables no greater than 18" apart. Provide vertical support as necessary to prevent cable sheering.
- H. Provide slack in cable to prevent cable system wear and to allow for access and service of the Video Cabling System and other building systems. Wrap the room when terminating in a Telecommunications Room (TR) or distribution location.
- I. A minimum 3' slack loop shall be provided at the device end of the cable.
- J. Wall mount Optical Amplifier.
- K. Adjust Video Cabling System to meet the following parameters and test with one of these or other approved test equipment with 2-gigabit bandwidth range: Manufacturer: HP; Model: Lanalyzer or equal; Manufacturer: Scope; Model: Current handheld version by this manufacturer or equal.
 - 1. For RG11: Sweep testing and attenuation readings (plus manufacturers recommended allowances for connector loss) pass at:
 - a. 5 MHz < .7 dB
 - b. 300 MHz < 3.7 dB
 - c. 450 MHz < 4.5 dB
 - d. 900 MHz < 6.3 dB
 - e. 1200 MHz < 7.5 dB
 - f. 1500 MHz < 8.5 dB
 - 2. For RG6: Sweep testing and attenuation readings (plus manufacturers recommended allowances for connector loss) pass at these reading or better dB per 100 ft:
 - a. 5 MHz < .4 dB
 - b. 50 MHz < 1.0 dB
 - c. 100 MHz < 1.4 dB
 - d. 300 MHz < 3.0 dB
 - e. 450 MHz < 4.5 dB
 - f. 900 MHz < 4.2 dB
 - g. 1000 MHz < 4.5 dB
 - h. 1450 MHz < 6.2 dB
- L. Labeling

1. Conform to requirements of Section 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
2. Update room numbers to final room numbers on all documentation.
3. As-built drawings will be placed in each Telecommunications Room (TR) next to TV distribution placement location.
4. Copies of as-built drawings shall be securely mounted in Telecommunications Room(TR) to be used as references for on-going Video Cabling System management.

M. Preparation

1. Evaluate DB load
2. Evaluate MATV capability
3. Evaluate designated installation site
4. Investigate and validate cabling pathway
5. Provide for MATV required outputs on desired formats such coax or SMAP fiber and correct where necessary on shop drawings.
6. Coordinate with project management schedules and installation.

N. Installation

1. Install Horizontal Video Cabling: Furnish, install, and test RG6 for runs 100' or less and RG11 for runs in excess of 100', rated at 2-gigabit bandwidth, quad shielded, solid conductor, UL listed and code compliant cable. All RG-11 runs will be "pigtailed" with RG-6 from the hallway into the patient's/room homerun TV outlet box. Quantity as required. CommScope or equal.
2. 75-ohm Terminators shall be installed on all unused ports.
3. Install Video Trunk Line Cabling (Project dependent) : Furnish, install, and test ½" RG11 (as per design) rated at 2-gigabit bandwidth minimally, quad shielded, solid conductor, UL listed and code compliant cable.
4. Install SMAP fiber feed, in a redundant terminated secondary feed. (as per design)
5. Install Directional Couplers: Furnish and install Directional Couplers with -100 dB radiation shielding, isolation values as required for proper dBmv levels and port as specified. Coupler outlet dB value calculated to obtain a 10-dB power output at TV outlet. Quantities as required. Blonder-Tongue SRT Series or equal.
6. Install Splitters: Furnish and install Splitters with -80 dB radiation shielding, ports as required. Quantities as required. Blonder-Tongue SDS Series or equal.
7. Install Cable Connectors: Furnish and install RF connectors for RG6 and RG11 cable for use with radiation proof passives or as directed by UCDH standards. Quantities as required. Holland Electronics SLEV or Beldon PPC style compression fittings. Install infrastructure for connectivity to nurse call TV connectivity as required.
8. Install all equipment and components in accordance with manufacturer's written instructions, in compliance with CEC, and with recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.
9. All fiber connections shall be SC/APC style connectors
10. All cable to be swept to 2 GIGHZ

O. Examination/Acceptance

1. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances.

2. As-built drawings updates:
 - a. Provide documentation on moves, adds and changes to the Video Cabling System.
 - b. Updating distribution values and transfer to as-built drawings and provide update to UCDH representative.
3. Run Lengths:
 - a. Confirm with test results that the total length does not to exceed limitation expressed herein.
4. Provide room location of all cables
5. Provide documentation of all tests as specified by this and other Sections in the following formats. Submit in CAD and in hard copy form (2 copies).
6. Submit interim test reports to the UCDH representative and 'final' acceptance test reports (where only one test iteration is required consider it be the 'final').
7. Complete walk thru with UCDH representative.
8. Provide overview of operation and maintenance on equipment that has adjustable settings.
9. Complete punch lists as necessary.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 3. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 4. Replace malfunctioning or damaged items.
 5. Retest until satisfactory performance and conditions are achieved.
 6. Prepare television equipment for acceptance and operational testing.
 7. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
 8. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
- C. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 1. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 2. Distribution System Acceptance Tests:
 - a. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.

- b. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard television receiver to measure signal levels and check picture quality at all user-interface outlets.
 - c. Test the signal strength in dBmV at 55, 151, 547, and 750 MHz.
 - d. Minimum acceptable signal level is 10 dBmV (1000 mV).
 - e. Maximum acceptable signal level over the entire bandwidth is 17 dBmV.
 - f. Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
 - 3. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed- on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.
- D. Headend and distribution system will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Cap all unused connectors and seal weather tight.

3.3 DEMONSTRATION

- A. Train UCDH maintenance personnel to adjust, operate, and maintain MATV equipment.
 - 1. Train UCDH maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 - 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 - 3. Demonstrate programming and tuning of satellite receivers.

3.4 CLEAN UP

- 1. Clean up per 01 00 00 General Requirements

END OF SECTION

SECTION 27 51 16
PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of an Overhead Public Address System.
- B. Related Work: Equipment and materials provided and installed by others, and require coordination with the work of this Section, shall include the following:
 - 1. Conduits and back-boxes
 - 2. 120v, 60Hz Outlets

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- D. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- E. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.3 SYSTEM DESCRIPTION

- A. Provide and install all equipment to provide a VoIP overhead paging system including, but not limited to, outlet boxes, cabling, speakers, and all other necessary equipment to provide a complete operating system.
- B. The design of the overhead paging system shall be centered on the Informacast platform that integrates the UCHD Cisco Call Manager through a SIP (Session Initiation Protocol) trunk.
- C. Provide system design and illustrate on the T drawings.
- D. Provide Overhead Public Address System covering all corridors, general work areas, public areas and other areas as required by the customer and reviewed by UCDH.
- E. Overhead Public Address System shall be constructed to provide audible overhead paging to any one of the UCDH provided zones.
- F. Components installed outdoors shall meet minimum IP54 standard for exterior damp locations.
- G. Ceiling speaker placement shall be designed using the industry standard paging system speaker spacing formula of twice the distance from the floor to ceiling for speaker placement. For example, a 9 foot ceiling would require speakers be spaced 18 feet apart on center.

- H. High quality speakers designed for IP PoE operation shall be strategically placed throughout the facility to ensure even coverage and optimal audio quality. Speakers shall have ambient noise detection and talkback capabilities.
- I. Designer and installer are required to designate and use colors to create a customer expected aesthetically and visually appealing environment.

1.4 SEISMIC DESIGN REQUIREMENTS

- A. Items requiring adherence to CBC Chapter 16A - OSHPD:
 - 1. Ceiling Speaker
 - 2. Grill
 - 3. Back Box
 - 4. External Speaker

1.5 SUBMITTALS

- A. Conform with the Division 1 33 00 requirements Submittal Procedures.
- B. Submit shop drawings and product data with the following information.
 - 1. Floor plans showing the entire project area illustrating all audible overhead paging devices
 - 2. Floor plans showing the entire project area cable paths
 - 3. Floor plans showing speaker zone designation
 - 4. Speaker hardware cut sheets

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused.
- B. All materials shall be warranted for a period of one year from date of installation.

PART 2 - PRODUCTS

2.1 PUBLIC ADDRESS PRODUCTS

- A. Speakers:
 - 1. Algo #8188-IC Informacast IP (ceiling), or approved equal.
 - 2. Algo #8198-IC Informacast IP PoE+ (ceiling master speaker), or approved equal.
 - a. Algo #1189 (ceiling remote speaker)
 - 3. Algo 8196 (IP PoE+ outdoor horn), or approved equal.
- B. Cabling: CAT-6A Plenum Twisted Pair.
 - 1. GenSpeed #7151855, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install paging system and accessories in compliance with Manufacturer's instructions..
- B. Label all paging system speakers with device area covered e.g. zone identifier, Telecommunications Room (TR) where terminated, and sequential speaker number.

3.2 PREPARATION

- A. Registered Communications System Designer shall provide design drawings for OSHPD and/or building permit.
 - 1. Drawings shall indicate speaker cable pathway
 - 2. Drawings shall indicate firewall penetrations
 - 3. Drawings shall indicate elevations showing rack mounted amplifier placement
 - 4. Drawings shall indicate zone assignment exceptions

3.3 INSTALLATION

- A. Install cabling per fire code. Install all wiring in conduit only where applicable by fire code.
- B. Install cabling and speaker locations as indicated on the drawings.
- C. Install speakers using home run 4 Pair Plenum CAT-6A cables.
- D. Adjust speaker volume so that speaker dB level is no less than 10 dB and no more than 15 dB above ambient noise level in area.

3.4 EXAMINATION

- A. Contractor shall adjust zones and volume settings during acceptance testing as recommended by UCDH representative.
- B. Contractor shall demonstrate proper operation of all system components and functions during the acceptance tests.
 - 1. Contractor shall provide all test equipment necessary to test systems, including but not limited to an impedance meter and sound pressure level meter.
 - 2. Contractor shall pretest all Overhead Public Address System devices and functions, and shall document the results of this pretest before calling for final acceptance test. Pretest shall also include testing for buzzes and rattles.

3.5 FIELD TESTS

- A. Contractor shall test all systems and devices and shall submit a report certifying that the installation is in full compliance with the contract documents. Testing of the system shall be performed with test instruments and procedures recommended by the manufacturer, and in full conformance with NEC guidelines. Upon review of these documents by UCDH representative, final acceptance tests shall be scheduled for all concerned parties. The test reports shall include the following:
 - 1. A complete list of all equipment installed.

2. Certification by the Contractor and manufacturer's representative that all equipment is properly installed, functional, and conforms to the requirements of this Section.
3. Certification by the Contractor that all systems and devices have been tested for proper operation.
4. A spreadsheet having the measured and calculated impedance across each speaker zone line plus the resistance to ground of each speaker zone wire as metered at the equipment rack. Contractor shall resolve any discrepancies between measured and calculated impedances. Contractor shall provide an impedance meter during all testing. This requirement shall apply to all new and existing speaker zones.
5. Contractor shall perform a "buzz and rattle" test of the speakers by inserting pink noise into the system and running the output of the amplifiers at 90% of their rated output voltage. Contractor shall listen to each speaker for unwanted buzzes and/or rattles and shall correct the cause of any found buzzes and rattles. This test shall be done after hours with the building empty due to irritating noise created during this test.
6. As-built floor plans with required port count for the system.
7. Technician's name, company, and date of test.

3.6 COMMISSIONING AND ACCEPTANCE

1. Contractor shall demonstrate proper operation of all system components and functions.
2. The final acceptance test shall be performed in the presence of UCDH representative. The final acceptance test shall include a complete test of all system devices and functions, and any additional testing requested by UCDH representative. Contractor shall provide all personnel and equipment necessary to accomplish the test. A copy of the test result shall be provided to the UCDH representative.

3.7 RECORD DRAWINGS

- A. Maintain a complete set of prints and shop drawings of the work forming a part of the Public Address Systems. As work is installed, carefully draw on prints, in colored pencil, actual location of work including depth of underground runs, if any, with dimensions from permanent walls, walks, etc. Wiring diagrams and details shall be included.
- B. Upon completion of the project, transfer this information to reproducible Drawings and updated CAD (AutoCAD DWG files), submit to UCDH.
- C. One additional complete set shall remain on the job site in folders secured inside the electronic racks.
- D. Record Drawings shall include:
 1. Complete wiring diagrams for all components, including cable types and quantities, conduit routings, cable routing, floor plans indicating device locations, conduit sizes, riser diagrams, etc.
 2. Complete elevation, mounting, and point-to-point and termination drawings for all devices. Partial or "Typical" drawings will not be accepted.
 3. Dimensioned drawings of all racks and any fabricated equipment showing locations of all major components.
 4. A Master Legend/Spreadsheet on the drawings that identifies all devices, device location on the drawings, wire label verbiage, and termination points.
 5. A complete list of all equipment installed, including serial numbers of major components.

END OF SECTION

SECTION 27 52 23
NURSE CALL CODE BLUE SYSTEMS

GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of the complete installation and integration of a Nurse Call system.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. Each Nurse Call system shall be capable of operating as a stand-alone system, with the ability of interfacing to the existing Hospital-wide Nurse Call network.
 - 1. Nurse Call Master Stations
 - a. The Nurse Call Master Stations (NCMS) shall be at the caregiver stations and as indicated on the Drawings. The NCMS shall be the primary call annunciation point for the Nurse Call system. Each NCMS shall consist of a full color touchscreen monitor and an alphanumeric display microphone, keypad, and handset.
 - 2. Nurse Call Central Station
 - a. The Nurse Call Central Station shall be located in the Telecommunications Room (TR) as indicated on the Drawings. The Nurse Call Central Station shall be the primary processing point of the Nurse Call system.
 - 3. Patient Stations
 - a. Patient stations shall provide the interface between the patient and the NCMS. Each Patient Stations will display on its face plate a light indicating a call has been placed and a separate light indicating an open audio path. Each patient station shall be able to accept input from peripheral devices including emergency stations, staff presence stations, remote switches, and auxiliary devices. Patient stations shall be microcomputer based.
 - 4. Staff Stations
 - a. Staff stations shall provide an interface between the nursing staff and the nurse control station. Each Staff Stations will display on its face plate a light indicating a call has been placed and a separate light indicating an open audio path. Each staff station shall be able to accept input from peripheral devices including emergency stations, staff presence stations, remote switches, and auxiliary devices. Staff stations shall be microcomputer based.
 - 5. Emergency Stations

- a. Provide emergency pull cord stations in the toilets and in other locations as indicated on the Drawings. Stations shall meet UL waterproof requirements. The faceplate shall be electrically isolated from internal electrical components.
- 6. Corridor Lights
 - a. Provide corridor lights at the entrance to the patient rooms (dome lights) and in the corridors to indicate the wing of a patient call (zone lights) as indicated on the Drawings.
- 7. Smart Dome Lights
 - a. Provide smart dome lights at locations indicated.
- 8. Staff Presence Stations
 - a. Provide wall mounted recessed manual staff presence stations at the locations indicated on the floor plans. These stations shall report back to the NCMS monitoring the patient room.
- 9. Entertainment and Environmental Interface Units
 - a. Provide recessed mounted interface units for the patient entertainment system (television) and the patient-controlled lighting fixture for each bed. Interface units may not be shown on the Drawings but shall be installed in a location accessible from the patient room. These units shall provide control of the television set and lighting fixture through the patient control unit and patient station.
- 10. Vocera
 - a. Provide Vocera paging capability for each of the caregiver stations. These systems shall operate in either a manual mode or an automatic mode, as selected from the NCMS.

1.3 SEISMIC DESIGN REQUIREMENTS

- A. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16A. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- B. Supports for such items, including racks and rack cabinets, conduit, cable trays and similar, shall be provided support, bracing, and anchorage designed by the Contractor in accordance with the following criteria:
 - 1. Design to resist seismic forces in accordance with CBC Chapter 16A.
 - 2. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, and Spectral Response Acceleration.

1.4 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 28 10 00 ACCESS CONTROL
- D. 28 20 00 VIDEO SURVEILLANCE
- E. 28 31 00 INTRUSION DETECTION

F. 28 49 00 ELECTRONIC PERSONAL PROTECTION SYSTEMS

1.5 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020

1.6 SUBMITTALS

- A. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- B. Submit product data submittals to UCDH for review and approval.
 - 1. Submit product data submittals system, product, device, and equipment product data cutsheets.
 - 2. Manufacturer's published cutsheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided.
 - 3. Mark cutsheets to indicate the associated Section.
 - 4. Provide documentation of Contractor's factory-trained and authorized service representatives.
 - 5. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in Abode Acrobat or Bluebeam Revu complete with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.
- C. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 8. Include user defined information per floor and per system component.
 - 9. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- D. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
 - 1. Prepare O&M manual in 8-1/2" x 11" letter size sheet format, labeled, grouped, and ordered, with bookmarks as indicated in a Table of Contents.
 - 2. Include manufacturer's system and product data sheets, operation and maintenance information, troubleshooting and servicing instructions, routine maintenance instructions, and copies of all programming sheets.
 - 3. Provide a copy of the final approved acceptance testing reports and documentation.
 - 4. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 - 5. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Abode Acrobat or Bluebeam Revu .pdf format.

- E. Submit as-built drawings submittals to UCDH for review and approval.
 - 1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 - 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 - 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 - 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 - 5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Units and components offered under this Section shall be covered by the manufacturer's warranty for a minimum of two years from date of UCDH acceptance of the project, a copy of which shall be included in the shop drawings submittals. Submitted system shall have been used on at least five projects of similar size and scope as this project. A reference of these similar systems shall be provided.
- C. Vendor shall provide 24×7×365 support to validate features and functionality for a period of 30 days following the opening of the unit.
- D. A factory-trained and authorized service representative shall perform the work of this Section.
- E. Provide documentation stating that spare parts will be continued to be manufactured or be stocked and available for a minimum of 5 years after the complete system acceptance by UCDH representative. Including equipment not manufactured by West Com.
 - 1. Provide spare parts minimum of 10% of each item or 1 whichever quantity is greater.

1.8 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PRODUCTS

2.1 DEVICES

- A. General

1. UCDH has a sole source agreement with West-Com Nurse Call Systems, Inc. for all Nurse Call systems.
2. UCDH uses West-Com Novus in clinic environments and West-Com Novus Connect in Hospital environments.

B. NURSE CALL MASTER STATIONS

C. NURSE CALL CENTRAL STATIONS

D. PATIENT STATIONS

E. STAFF STATIONS

F. EMERGENCY STATIONS

G. CORRIDOR LIGHTS

H. SMART DOME LIGHTS

I. STAFF PRESENCE STATIONS

J. ENTERTAINMENT AND ENVIRONMENTAL INTERFACE UNITS

K. VOCERA INTEGRATION

2.2 GENERAL

A. System Operation and Description

1. The Nurse Call system shall provide a minimum but not limited to:
 - a. Enables a patient to alert a nurse of the need for any type of assistance
 - b. Provides a visual indication of where services are required
 - c. Must provide an audible signal indicating a call on the system
 - d. Must adhere to the state health department requirements
 - e. Must page or provide a wireless means of communicating to nursing staff
 - f. Must provide patient services from bed side, rest room or shower
 - g. Must be able to integrate with Patient bedside TV controls
 - h. Must be able to integrate with room lighting controls
 - i. Must be able to integrate with existing Nurse Call systems
 - j. Must be able to provide nursing statistics of responses
 - k. Must be able to provide manual locaters indicating a staff presence in a room
 - l. Must integrate with other devices, seizure alarm equipment, ventilators, and other auxiliary devices as required
 - m. Must be Ethernet network compatible
 - n. Must be able to be programmed to be supported from any nursing station on the floor or in the Hospital
2. Complete Vocera interface.

3. Complete Electronic Medical Records (EMR) integration.

EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Network cable and patch cables shall be provided in accordance with the requirements of Division 27 Communications Sections.

3.2 PREPARATION

- A. Thoroughly examine site for acceptance of device installation to verify conformance with manufacturer and UCDH requirements.
- B. Validate that the system is meeting the customers' needs and feature set at UCDH.
 1. Coordinate with construction management on scheduling details.
 2. Coordinate with UCDH to provide IP addresses.
 3. Coordinate with UCDH for fiber connectivity.
 4. Verify antivirus software and security updates have been installed per UCDH Security Standards.
 5. Coordinate Nurse Call network cabling with the structured cabling package in accordance with Division 27 Communications requirements.

3.3 INSTALLATION

- A. Install a fully functional Nurse Call System as required and approved by UCDH for the project
 1. No electrical outlet splitters allowed. Hospital approved UPS or power strip is acceptable.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1" x 1.5" with minimum 12pt font.. Handwritten labels are not acceptable.

- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 - 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.
- C. Onsite Acceptance Testing:
 - 1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

3.6 DEMONSTRATION AND TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate and train UCDH maintenance personnel as described below.
- B. Train personnel in the procedures and schedules involved in operating, troubleshooting servicing, and preventive maintenance of the systems. Provide a minimum of 16 hours training. Training shall be scheduled in more than one session, as agreed-upon by Contractor and UCDH.

- C. Train caregiver personnel in proper use of the systems. Periods of training shall be coordinated with the UCDH representative to assure all nursing shifts receive the required training.
- D. Schedule all training through the UCDH representative a minimum of 14 days in advance.
- E. Provide on-site assistance in adjusting sound levels and adjusting controls to suit actual occupied conditions on an as-requested basis for the first year of operation. Provide a minimum of six visits to the site for this function.
- F. Provide completed documentation of all tests as provided by the UCDH representative. Complete repairs at the time of inspections and review.
- G. Vendor shall provide 24×7×365 support to validate features and functionality for a period of 30 days following the opening of the unit. 2-hour response time required.
- H. Provide spare parts to UCDH at the time of building occupancy. The UCDH representative shall provide to the Contractor a list of spare parts to be purchased and shall notify the Project Manager of the required purchase of spare parts acceptable to all parties.
- I. Deliver and obtain a receipt for spare parts from the designated UCDH representative.
- J. Comply with AHJ to provide a fully functional system to comply with state and local codes and authorities to provide a compliant Nurse Call system.

END OF SECTION

SECTION 27 53 13
CLOCK 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 a centrally controlled clock system as described in this Section, including but not limited to:
 - 1. Centrally controlled clocks
 - 2. Elapse time clocks
- B. Related Work: Equipment and materials provided and installed by others, and require coordination with the work of this Section, shall include the following:
 - 1. Conduits and back-boxes
 - 2. 120v, 60Hz AV Outlets

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.3 SYSTEM DESCRIPTION

- A. A wired master clock system consisting of master clocks and secondary clocks including analog and digital displays.

1.4 REFERENCES

- A. Most Recent California Building Code (CBC).
 - 1. California Energy Code, Title 24, Part 6 of the CBC
- B. NEMA ICS 6 enclosure for Industrial Control and Systems.

1.5 SUBMITTALS

- A. Conform with the Division 01 00 00 Submittal Procedures.
- B. Submit the following with shop drawings:
 - 1. Technical data showing exact types and quantity of all Simplex clock devices. Highlight or otherwise identify specific components on catalog cut sheets.
 - 2. In addition, the legend must include the quantity and model numbers
 - 3. Point to point details that indicate the interconnections between the items of equipment.

4. Provide single line riser diagram.
5. The title page of the shop drawings must include the following statements:
 - a. A set of approved clock shop drawings stamped by UCDH engineer of record shall be on the job site and used for installation. Any deviation from approved shop drawings, including substitution of devices, shall be approved by UCDH representative.
 - b. Any discrepancies between the shop drawings, applicable code or recognized standards shall be brought to the attention of the UCDH representative via the RFI process.
 - c. Stamp and signature of the design professional of record.
 - d. Submit simultaneously with shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets.
 - e. Submittals will be automatically rejected if complete product listing information does not accompany submittal.
- C. Provide sequence of operations to show how the system will react to master clock corrections.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Provide documentation stating that spare parts will be continued to be manufactured or be stocked and available for a minimum of 5 years after the complete system acceptance by UCDH representative.
 1. Provide 10% spares, minimum 1 additional clock, for replacement if a clock fails and while replacement is being shipped.
- C. Manufacturer shall have local service organization in the Northern California area.

PART 2 - PRODUCTS

2.1 DEVICES

- A. Acceptable manufacturers:
 1. Clock system and components:
 - a. Simplex
- B. All components by same manufacturer. If clocks are other than Simplex, submit certification that clocks will operate on the existing system and will not adversely affect the operation of the existing system.

2.2 CENTRALLY CONTROLLED CLOCKS

- A. Clock system: Centrally controlled with master clock, secondary clocks, elapsed-time clocks, and wiring system.
- B. Synchronous wired.

- C. 120v/60Hz AC.
- D. All components: UL approved.
- E. Surface, semi surface and flush mount clocks are typical round, 12" surface mount, 4-wire, individually reset clocks.
- F. Provide clocks designed to operate fifteen years without servicing.
- G. Modern styled, satin white dials with black minute and hour hands, and red sweep-second hand.
- H. Bezels: Etched and black in color
- I. Including 4-wire polarized disconnect plug.
- J. Clock crystals: slightly convex to minimize glare and reflection.
- K. Simplex 6310 series or equal.

2.3 ELAPSE TIME CLOCKS

- A. Surface mount with separate installed single gang push button, start/stop/reset control station.
- B. Rectangular digital clock with black face and 4" red numerals.
- C. 120v/ 60Hz AC with integral battery backup.
- D. All components: UL approved.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and technical specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Connect all secondary clocks in parallel on 3-wire circuit.
- B. Install and wire system in accordance with manufacturer's recommendations.
- C. Connect the clock system to the existing clock relay panel to synchronized clocks throughout the existing building where applicable.
 - 1. Provide a specific demarcation point so that suite can be isolated for service, no clock locations are acceptable.
- D. Coordinate the connection to the existing hospital with UCDH representative.
- E. Test and prepare to commission system.

3.3 EXAMINATION/ACCEPTANCE

- A. The UCDH representative reserves the right to request additional validation of the system control equipment
- B. Upon completion of the installation of the clock system, Contractor shall coordinate an acceptance test. This must be performed in the presence of UCDH representative. The acceptance test must successfully demonstrate all functions required in the contract.
- C. Provide clear and concise operating instructions that gives, in detail, the information required to properly operate the equipment and system.

END OF SECTION

SECTION 275319 - DISTRIBUTED ANTENNA SYSTEM CELLULAR

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Distributed Antenna System (DAS) to distribute multiple cellular services, primarily in- building — herein "System".
- B. Base Bid Work
 - 1. The work of this section includes furnishing materials, installation, and coordination through the General Contractor with other trades for a complete, operational, and balanced distributed antenna system. Provide a complete turnkey system that supports frequencies and services throughout the coverage spaces specified herein. Furnish materials, accessories, fasteners, etc., and the labor and associated services necessary for a complete and operational System, whether expressly stated or not. Coordinate the work of this section with other trades through the General Contractor.
 - 2. The work of this section includes the following:
 - a. Provide project management services.
 - b. Coordinate antenna placement and mounting coordination with the General Contractor and affected trades, confirm mounting with both the architect and the owner.
 - c. Include installation, system functionality testing, and carrier integration.
 - d. Provide coordination with the overall construction team for usage of pathways provided by others.
 - e. Include patch cords to connect System equipment.
 - f. Manage wireless service providers' connection to the System.
 - g. Manage E911 coordination and integration.
 - h. Manage FCC registration including Part 90 requirements and FCC licensing Provide system acceptance testing and turn over to owner.
 - j. Provide warranty information for all active and passive system elements.
 - k. Provide maintenance and support services.
 - 3. Power Service:
 - a. Coordinate with the electrical contractor the power provisions required for the System. The DAS contractor is solely responsible to ensure proper electrical power service.
 - 4. Coordination Requirements:
 - a. Ceiling Types: Understand every ceiling type and its interaction with the System. For example, some ceiling types may impede RF signals and, subsequently, performance.
 - b. Mounting Details: Coordinate antenna mounting and the resulting RF performance. Coordinate with both the architect and the owner. Adjust as approved to optimize performance.
 - c. Pathways: Coordinate placement of System cables within pathways provided by others. Only place System cables into pathways provided by others with their permission.
 - d. Fiber Distribution System: Coordinate the System's fiber distribution requirements with the backbone fiber cabling contractor. Provide patch cords connect equipment to the fiber distribution system. Ensure compatibility with the cabling described in section 271300, "Backbone Fiber Optic Cabling".

C. Work Covered Under Other Sections

1. Electrical power — raceways, junction boxes, circuits, branch wiring, and receptacles
2. Pathways — backbone conduits, primary pathways (such as cable trays), conduits, sleeves
3. Telecommunications Rooms — equipment support (racks/frames), power service, cooling, and grounding
4. Backbone Fiber Optic Cabling
5. Wired network

D. Related Sections

1. Comply with the Related Sections requirements of the following:
 - a. Section 27 05 26 "GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS"
 - b. Section 27 05 29 "HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS."
 - c. Section 27 05 33 "CONDUITS AND BACKBOXES FOR COMMUNICATIONS"
 - d. Section 27 05 36 "CABLE TRAYS FOR COMMUNICATIONS SYSTEMS"
 - e. Section 27 05 41 "FIRE-STOPPING SYSTEMS"
 - f. Section 27 05 53 "IDENTIFICATION FOR COMMUNICATIONS"
 - g. Section 27 11 16 "COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES"
 - h. Section 27 53 29 "EMERGENCY RESPONDER RADIO COMMUNICATION SYSTEM"
 - i. Section 27 11 23 "COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK"
 - j. Section 27 13 43 "COMMUNICATIONS SERVICES"
 - k. Section 27 15 00 "COMMUNICATIONS HORIZONTAL CABLING"
 - l. Section 27 13 00 "COMMUNICATION BACKBONE CABLING"

1.2 SYSTEM DESCRIPTION

A. System Description

1. The System, or "DAS", shall reliably distribute RF signals and/or wireless services throughout the specified frequency ranges and the specified coverage areas. The System shall be implemented based on proven technology that can seamlessly integrate with the rapid evolution of wireless technologies and business applications. The System shall be flexible and shall easily accommodate additional wireless services within the System's frequency bands without requiring significant upgrades or system modifications.
2. The System shall include subsystems, equipment, components, transmission media, connection/ termination apparatus, etc., necessary for a complete operating system as described herein.
3. The System's head-end and signal sources are existing and located in the North Admin building. UCDH is coordinating any modifications of the head-end with carriers. This project will provide fiber remote units to connect back to the existing head-end.
4. In the future, the System's head-end will be relocated to the new RHT tower. This DAS system must be compatible with planned RHT head-end. Migration of the head-end connection will be excluded from this scope of work.
5. The System shall have lightning protection.

B. Design Criteria

1. Frequency Range: The System shall support frequencies between 700 MHz to 2600 MHz C band.
2. The System shall distribute RF coverage at levels indicated below in the following areas of the building(s) — herein specified coverage areas:

- a. Floor areas
 - b. Basement
 - c. General Use spaces (break rooms, staff rooms)
 - d. Mechanical / Electrical Rooms
 - e. Restrooms
 - f. Stairwells
 - g. Elevators
 - h. Patient
RoomsExam
Rooms
 - j. Operating Rooms
 - k. Procedure / Treatment Rooms
 - l. Penthouse
 - m. Sub-Floor and other ancillary spaces
3. The System shall be able to simultaneously support the following wireless services, technologies, and associated frequencies — values in MHz:
- a. Wireless Operators Verizon, T-Mobile, AT&T
 - b. C band should be considered for Future Deployment

Service	Uplink	Downlink
Cellular	824 - 849	869 - 894
PCS	1850 - 1915	1930 - 1995
AWS	1710 - 1755	2110 - 2155
700 LTE	698 – 716, 777-787	728 - 757
BRS/EBS	2496 - 2690	
CBRS	3400-4200	

- 4. The System shall have the capability for separate control over each service (or wireless operator) to allow adjustment and control of power levels without disturbing other services/operators.
- 5. The System shall support multiple services in a modular architecture so services can be added or removed without requiring new infrastructure, without readjustment of signal power levels, and disturbing existing services.
- 6. The System shall enable services to be added without requiring additional cabling or antennas.
- 7. The System shall not impede any management features or functionality of any attached network and/or device management system.
- 8. The System shall allow for proactive management and end-to-end alarming of active electronics.
- 9. The System shall be able to engage with 3rd party SNMP-based element management systems and provide fault management information.
- 10. The Owner prefers that the System's antennas be mounted below ceiling grids. Coordinate the RF design, antenna placement, and mounting with both the Architect and the Owner throughout the project.
- 11. E911: The System must support E911 and associated sectors.

12. Cellular Services:

- a. The System shall support the latest advancement in mobile broadband and LTE, to support the growth of mobile computing, low-latency transmission, and the demand for higher throughput requirements as necessary for different applications.
 - b. The System shall provide RSSI cellular signal strength of -75 dBm or stronger for 3G (-85 dBm for LTE/4G) services throughout at least 95% of the required coverage areas, and the System shall provide a signal strength of -85/-95 dBm, minimum, for the remaining 5% of the building.
 - c. The System shall provide RSRP signal strength of at least -104 dBm for LTE / 4G services.
 - d. The System shall provide at least 8 dB higher (signal dominance) than the cellular carriers' macro signal based upon the current macro coverage.
 - e. The System shall provide RSRQ signal quality of at least -14 throughout at least 95% of the required coverage areas.
 - f. The System shall provide a SNIR signal-to-noise ratio of at least 10 dB or better throughout the coverage areas at least 95% of the required coverage areas.
 - g. The System shall provide a PIM level of 100 dBm / -143 dB or better on segments for the 850 MHz frequency band.
13. The System and the associated wireless devices shall comply with the FCC and regional regulatory authorities' emission rules for wireless devices.
- a. Refer to: FCC advisory: "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures, and Practical Guidance", FCC's OET Bulletin 65, and FCC Rule 47-part 17 and (ANSI/IEEE C95.1-1992) Hazardous Emission document.

1.3 SUBMITTALS

- A. Comply with Submittal procedural, quantity, and format requirements.
- B. Submittal Requirements with the Bid:
 1. Statement of Work that describes the entire proposed scope.
 2. Acknowledge that the specified equipment will be installed per design or provide a substitution request letter.
 3. A certificate from the manufacturer of the equipment to be installed stating that the DAS installer is trained and qualified on the equipment.
- C. Submittal Requirements Prior to Start of Construction:
 1. Product data submittal
 2. Shop Drawings Submittal: Include the following in the shop drawing submittal:
 - a. Pathway and cable support systems
 - b. Wall and/or rack elevations, showing equipment layout, space requirements and integration with other systems (outside the scope of the DAS)
 - c. Installation details for unique antenna mounting conditions, specialty cable hangers, and other components specific to the system not covered under the contract drawings.
 3. Compliance with permitting agency requirements
- D. Submittal Requirements Prior to Acceptance Testing:
 1. Test equipment to be used during commissioning that shows current calibrations and test data.
 2. Acceptance Test Plan (ATP): In this submittal, describe in detail the procedure for testing the System's performance and balancing the System's signal strength, including a description

of the test data (or an example of the test report). The procedures and results shall demonstrate the desired services have been successfully deployed and tested. The DAS must be deployed with the WSP criteria and approval.

E. Submittal Requirements at Close Out:

1. As-Built Drawings, including.
 - a. Cable routing, splitters, couplers, and coverage antenna locations
 - b. Active component locations, layout, and configuration
2. Test Reports
 - a. Cable test results: include every cable segment.
 - b. Validation survey report
3. Warranty Documents
 - a. Submit Contractor's System warranty, including procedures and contact information for service calls under warranty.
 - b. Submit Manufacturers' warranties, including procedures and contact information for service calls under warranty.

1.4 QUALITY ASSURANCE

- A. Comply with manufacturers specifications.

PART2 PRODUCTS

2.1 MANUFACTURERS

- A. DAS required manufacturer CommScope Inc.

2.2 SUBSTITUTIONS

- A. Comply with the Substitution requirements.

2.3 DATA COLLECTION TEST EQUIPMENT

- A. Specifications

1. Accuracy: 1 dB (across basic RF input power range)
2. Dynamic range: -120 dBm to -20 dBm at 30 kHz
3. Frequency range: 10 MHz to 6GHz<, 26GHz to 40GHz>
4. Technologies: 4G LTE,5G, C-Band&CBRS
5. Antenna configuration: Capable of 2x2 and 4x2 4X4 LTE MIMO measurements
6. Connection: Bluetooth or USB to Windows laptop or Android tablet
7. Power: Hot-swappable batteries

- B. Manufacturers, or equal:

1. PCTEL — IBM/ex
2. Keysight — Nemo
3. FalconSmart — FalconKitt
4. Enhancell — Echo
5. Accuver — XCAL
6. Infovista — TEMS

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with manufacturers specifications.

3.2 PRE-INSTALLATION AND COORDINATION

- A. Coordinate RF rebroadcasting agreements with WSPs.

- B. Represent the Owner during negotiations with the WSPs to obtain their approval.

- a. Examination and Preparation

- 1. Examine equipment rooms, pathways, power service, and other aspects for completeness, the compatibility with the work of this section, and the readiness for connections with the work of this section.

3.3 PROJECT MANAGEMENT SERVICES:

- A. Assign a project manager, a single-point-of-contact, to this project with overall responsibility for communications and ultimate delivery of contracted materials, installation, performance criteria, and services. This PM shall be responsible for interfacing with the Owner, telcos, the General Contractor, and their own subcontractors.
- B. Present the system design to the Owner, coordinate cable routes with the telecom engineer.
- C. Represent the Construction Team to coordinate on-site construction activities with the General Contractor and coordinate receiving Telco services ordered by the Owner.
- D. Manage the wireless operators bringing their equipment and services into the facility.
- E. Close out the project with the Owner.

3.4 INSTALLATION

- A. Coordinate the installation and schedule with the owner, General Contractor, and electrical contractor prior to the start of installation activities. Once the owner and General Contractor have accepted the coordination and schedule, proceed with the installation.
- B. Indoor Antenna Installation
 - 1. Mount according to manufacturers' recommendations.
 - 2. Mount at locations identified within DAS design drawings. Avoid mounting locations as follows:
 - a. Adjacent to metal materials
 - b. Adjacent to RF signal sources
 - 3. Cable paths to antenna must match DAS design drawings.
 - 4. Deviation of installation details and/or locations must be coordinate with DAS design engineer.
- c. Change default passwords in accordance with the Owner's direction.
- D. Install latest software versions, firmware, and security patches.
- E. Disable unused communication ports, protocols, and access accounts.
- F. Test the following during installation: Sweep Testing (SYS RL/DTF, Load RL/DTF + short), PIM testing (PIM vs Time, DTP +Loads), Fiber Testing (OTDR+ Scopes) & CW Testing when applicable.
- G. System Balancing: Balance system component (e.g., antenna) signal strength to device signal levels.
- H. Connections to the System: Coordinate connection of wireless service providers to the System.
 - 1. Manage wireless operators' connections to the System.
 - 2. Assist the owner with the carrier coordination of this expanded system.
 - 3. Assist the owner with E911 services throughout the System.
 - 4. Integration includes BDA.
 - 5. If Alternate# is selected, manage integration of telemetry services and applications into the System. Coordinate the services and applications with the telemetry integrator. Provide

equipment and components required to support the wireless services and to make adjustments to the System necessary for full operation.

- I. Manage FCC License: Acting as a representative of the Owner, obtain required licenses for operation under FCC Regulations.

3.5 LABELING

A. General Requirements

1. Label equipment, components, and cables.
2. Labels shall be permanent, minimum 1" x 1.5".
3. Text shall be machine-generated minimum 12pt. font. Handwritten labels will not be accepted.
4. Labeling, label colors, and identifier assignment shall conform to the TIA-606 standard. Coordinate labeling and identifier assignment with the Engineer or Owner.
5. Submit a labeling plan compliant with the labeling requirements shown in the Technology drawings.

B. Equipment Labeling

1. Affix labels to equipment (such as fiber remote units) such that they will be clearly visible.

C. Cable Labeling

1. Affix label as close as practical to each end of each cable.
2. Cable labels shall fully wrap around cable jackets resulting in a self-laminating result.

D. Antenna Labeling

1. Affix labels to antennas such that they will be clearly visible.

3.6 ACCEPTANCE TESTING / VALIDATION SURVEY

A. Complete acceptance testing in accordance with the approved Acceptance Test Plan (ATP). Only a qualified person or persons familiar with DAS and cellular data collection tools shall test the System.

B. Perform an on-site survey to validate RF coverage (signal strength) throughout coverage areas (listed in Part 1) using approved test equipment.

1. Outdoor Perimeter Area: Survey the building perimeter on the ground level within 5 to 10 meters of the entire building.

C. Testing Procedure

1. Verify that remote units for the area under test are on.
2. Collect validation survey data continually at two-second or shorter intervals for each frequency band required in the "Wireless Operators" frequencies table (listed in Part 1).
3. Walk at a normal and constant pace.
4. Correlate validation survey data during the data collection with floorplans.
5. Use actual signal sources from wireless carriers to measure quality parameters. If carriers are not yet available, then use a signal generator connected to the head-end downlink (TX) interface via tested and approved coaxial cabling and connectors.
6. Record test frequencies and signal power with the date and time of each site walk.
7. Save site walk screen shots with a frequency span of 20 MHz relative to the center / measured frequency.

D. Equipment Requirements

1. Testing equipment must be calibrated within the past 12 months.
2. Allow test equipment to stabilize in the test environment prior to calibration for a minimum of thirty minutes. Changes in temperature can void the calibration.
3. Signal generator transmission frequency (MHz) and power (dBm) must be preapproved by the project engineer prior to testing. The control channel from the base station can be used as a

signal source as well.

4. Use a spectrum analyzer to capture and present signal strength, preapproved by the project engineer.

- a. Verify the spectrum analyzer is set to unity gain (0dB, frequency specific) so that the combination of analyzer and its antenna do not artificially increase measurement results.
 - b. Present signal strength as a graphical "heatmap".
 - 5. Use a Link Master LML Air Interface (or equivalent) tool to capture and present signal strength.
- E. Documentation
 - 1. Produce a validation survey report documenting the results including heat maps of the following:
 - a. RSRQ
 - b. RSRP
 - c. SNIR / LTE Reference Signal SNIR
 - d. Signal strength (RSSI)
 - e. Present signal results as a graphical "heatmaps".
- 3.7 FINAL INSPECTION
 - A. Participate in a punch walk with the engineer to demonstrate that the work complies with the requirements of this section.
 - B. Submit Certificate of Compliance with manufacturers specifications.
 - C. Submit final testing documentation to and obtain acceptance from the wireless carriers. Include these documents in the as-builts.
- 3.8 TURNOVER AND TRAINING
 - A. Pre-emptive Maintenance Minimum Requirements: Perform the following just prior to closeout.
 - 1. Clean filters, vents, and equipment components that may accumulate dust and dirt.
 - 2. Organize and manage cables and cords that have been placed.
 - 3. Update firmware with latest versions.
 - 4. Document and photograph any conditions that may affect the continuing function and long-term operation of the System and report to Owner.
 - B. Present the completed system and wireless services to the Owner, including functionality, features, ongoing maintenance, and warranty procedures. Demonstrate to Owner and engineer, system operation, including signal strength at selected locations. Turnover at least one set of both electronic and printed records, per the Owner's request.
 - c. For this System, provide up to 8 hours of training for the Owner.
- 3.9 WARRANTY PERIOD MAINTENANCE
 - A. Correct deficiencies within 24 hours of notification during the warranty period.
 - B.
 - 1. Splitters, couplers, and Coverage Antennas: 5-Year limited Warranty from date of system acceptance.
 - 1. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 - 2. Fiber- Optic Cable: 25-year limited warranty from date of acceptance
 - 3. Active Components: The earliest Of 1- year limited warranty from date of system installation
- 3.10 EXTENDED SERVICES
 - A. Submit costs for extended services (additional service levels beyond the warranty period) as follows:
 - 1. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and same- day issue response

2. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 24- hour issue response
- B. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 48-hour issue response.

END OF SECTION

SECTION 275329 - EMERGENCY RESPONDER RADIO COMMUNICATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Radio distribution system to support Emergency Responder Radio Communication System, Emergency Communications Systems, P25, and multiple first responder Radio Systems for Emergency Response wireless services, primarily in-building — herein "System".
- B. Base Bid Work
 - 1. The work of this section includes furnishing materials, installation, and coordination through the General Contractor with other trades for a complete, operational, and balanced Emergency Responder Radio Communication System, P25. Provide a complete turn-key system that supports frequencies and services throughout the coverage spaces specified herein. Furnish materials, accessories, fasteners, etc., and the labor and associated services necessary for a complete and operational System, whether expressly stated or not. Coordinate the work of this section with other trades through the General Contractor.
 - 2. The work of this section includes the following:
 - a. Provide Project management services.
 - b. Validate current and planned future emergency services and associated frequencies.
 - c. Coordinate antenna placement and mounting coordination with the General Contractor and affected trades, mounting confirmation with both the architect and the Owner.
 - d. Conduct initial on-site discovery survey "where applicable."
 - e. Provide detailed system design and drawings.
 - f. Review of pathways and enclosures for NFPA 1221 compliance
 - g. Provide coordination with the overall construction team and usage of provided pathways.
 - h. Provide installation and system commissioning.
 - j. Connect back to existing JMA system in the Davis Tower.
 - 1) Initial signal source will be provided by an existing Comba 800MHZ amplifier, also Westel 900MHZ amplifier-JMADA located in the Davis Tower. Note that this radio system also provided P25 and Paging service to the campus.
 - 2) In the future (-2030), a new NFPA compliant head-end system will be installed within the new RHT tower. The RHT head-end will eventually be the primary distributor and BDA location with donor antenna on roof. The contractor will coordinate cut-over dates where the old BDA in Davis Tower is decommissioned, and signal source switched over to RHT.
 - k. Provide NEMA 4-type waterproof cabinet.
 - l. Include patch cords (to connect System equipment)
 - m. Provide system acceptance testing and turn over to Owner.
 - n. Provide a warranty.
 - o. Provide maintenance and support services.
 - 3. Power Service:
 - a. Coordinate with the electrical contractor the power provisions required for the System. The ERRCS contractor is solely responsible to ensure proper electrical power service.
 - b. Provide distributed UPSs with a minimum runtime of 24 hours, with enclosures meeting NFPA 72 and 1221 requirements.
 - 4. Coordination Requirements:
 - a. Ceiling Types: Understand every ceiling type and its interaction with the System. For example, some ceiling types may impede RF signals and, subsequently, performance.

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- b. Mounting Details: Coordinate antenna mounting and the resulting RF performance. It may be preferred that antennas be mounted above or below ceiling grid. Coordinate with both the architect and the Owner. Adjust as approved to optimize performance.
- c. Pathways: Coordinate placement of System cables within pathways provided by others. Only place System cables into pathways provided by others with their permission.
- d. Fiber Distribution System: Coordinate the System's fiber distribution requirements with the backbone fiber cabling contractor. Provide patch cords connect equipment to the fiber distribution system. Ensure compatibility with the cabling described in section 27 13 00, "Communications Backbone Cabling".

C. Work Covered Under Other Sections

- 1. Electrical power — raceways, junction boxes, circuits, branch wiring, and receptacles
- 2. Pathways — backbone conduits, primary pathways (such as cable trays), conduits, sleeves
- 3. Telecommunications Rooms — equipment support (racks/frames), power service, cooling, and grounding
- 4. Communications Backbone cabling
- 5. Wired network

D. Related Sections

- 1. Comply with the Related Sections requirements of the following:
 - a. Section 27 05 26 "GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS"
 - b. Section 27 05 29 "HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS."
 - c. Section 27 05 33 "CONDUITS AND BACKBOXES FOR COMMUNICATIONS"
 - d. Section 27 05 36 "CABLE TRAYS FOR COMMUNICATIONS SYSTEMS"
 - e. Section 27 05 41 "FIRE-STOPPING SYSTEMS"
 - f. Section 27 05 53 "IDENTIFICATION FOR COMMUNICATIONS"
 - g. Section 27 11 16 "COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES"
 - h. Section 27 53 29 "EMERGENCY RESPONDER RADIO COMMUNICATION SYSTEM"
 - i. Section 27 11 23 "COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK"
 - j. Section 27 13 43 "COMMUNICATIONS SERVICES"
 - k. Section 27 15 00 "COMMUNICATIONS HORIZONTAL CABLING"
 - l. Section 27 13 00 "COMMUNICATION BACKBONE CABLING"

1.2 REFERENCES

- A. Comply with the References requirements of related sections (above).
- B. In addition to the codes and standards listed, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
 - 1. Committee of the Federal Register (CFR) Title 47 "Telecommunication", Chapter I "Federal Communications Commission" (FCC) Regulations:
 - a. Part 24, "Personal Communications Services"
 - b. Part 27, "Miscellaneous Wireless Communications Services"
 - c. Part 95, "Personal Radio Services."
 - 2. California Code of Regulations (CCR), Title 24

- a. Part 9, "California Fire Code" (CFC), Section 510
- 3. NFPA 72 "National Fire Alarm and Signal Code Regulations"
 - a. Chapter 24, "Emergency Communication Systems (ECS)"
 - 1) Pathway Survivability
 - 2) Two-Way Radio Communication Enhancement System
- 4. NFPA 1221 "Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems"

- C. Refer to Predictive Survey Design Report for coverage analysis.

1.3 SYSTEM DESCRIPTION

- A. System Description

1. The P25 System, or "ERRCS", shall reliably distribute RF signals for multiple first responder/emergency response wireless services throughout the specified frequency ranges and the specified coverage areas. The System shall be implemented based on proven technology that can seamlessly integrate with the rapid evolution of wireless technologies and business applications. The System shall be flexible and shall easily accommodate additional wireless services within the System's frequency bands without requiring significant upgrades or system modifications.
2. The System shall include subsystems, equipment, components, transmission media, connection/termination apparatus, etc., necessary for a complete operating system as described herein.

3. The System shall continuously distribute public safety radio signal throughout the building for 24 hours, minimum, during an event such as loss of utility power, as required per CFC and NFPA 1221. Therefore, the System requires continuous power with a runtime of 24 hours, minimum. The System requires dedicated circuit(s) to the equipment primary power source(s).
4. The active equipment and battery systems shall be electrically supervised and monitored by a supervisory service, or when approved by the AHJ, shall sound an audible signal at a constantly attended location, as required per CFC 510.4.2.4 #3.
5. Riser and feeder cables shall be plenum rated.
6. Feeder cables shall be connected to riser cables via either coaxial couplers/splitters or to fiber remotes.
7. Riser cables shall route through a 2-hour rated assembly.
8. Connections between riser and feeder cables shall be made within the 2-hour rated assembly, and passage of feeder cables into/out of 2-hour rated assemblies shall be fire-stopped to 2-hour ratings.
9. The System shall have lightning protection.

B. Design Criteria

1. Frequency Range: The System shall support all frequencies in the 800, 900 MHz bands.
2. The System shall distribute RF coverage throughout interior spaces.
3. The system shall be sized to support connectivity to the Davis Tower JMA head-end.
4. The system shall be expandable to support connectivity to a future JMA head-end in RHT.
5. The System shall support public safety (including "First Responder") wireless services and technologies, including the following:
 - a. Local police department
 - b. City police department
 - c. County sheriff
 - d. Fire department
6. The System shall have the capability for separate control over each service to allow adjustment and of control power levels without disturbing other services/operators.
7. The System shall support multiple services in a modular architecture so services can be added or removed without requiring new infrastructure, without readjustment of signal power levels, and disturbing existing services.
8. The System shall not impede any management features or functionality of any attached network and/or device management system.
9. The System shall allow for proactive management and end-to-end alarming of active electronics.
10. The System shall provide fault management information.
11. System Supervision
 - a. The System's electronic supervision shall monitor, at a minimum, the following:
 - 1) Normal AC power
 - 2) Loss of normal AC power
 - 3) Battery charger failure
 - 4) Low-battery capacity (i.e., to 70 percent depletion)
 - 5) Donor antenna failure
 - 6) Active RF emitting device malfunction/failure.
 - 7) Active system component malfunction
 - b. The System shall audibly annunciate alarms generated by the supervision.

- c. The System shall have a separate dedicated supervision panel located near the building's fire alarm control panel.
- 12. The Owner prefers that the System's antennas be mounted below ceiling grids. Coordinate the RF design and the antenna placement and mounting with both the architect and the Owner throughout the project.
- 13. The System shall interface with the Fire Alarm System, compliant with NFPA 1221.
- 14. The System shall monitor the power source, system status, and other critical aspects to the System's overall operation and shall provide alarming annunciation —all as required by the AHJ.
- 15. The System shall distribute public safety channels with -95 dBm (or stronger) signal strength (RSSI) throughout 95% of occupied building spaces and 99% in critical areas as defined in NFPA 1221 and IFC or as required by local ordinance and agencies, including local and city police, county sheriff, and fire departments. Confirm with the AHJ, Owner, and additional authorities' frequencies that will be in use at the time of facility opening.
- 16. The System shall have at a minimum 20 dB isolation between a donor antenna and all inside antenna as defined in NFPA 1221 or as required by local ordinance and agencies, including local and city police, county sheriff, and fire departments. Confirm with the AHJ, Owner, and additional authorities' frequencies that will be in use at the time of facility opening.
- 17. The sound quality shall meet or exceed DAQ 3.4 per SRRCS requirements ("Speech understandable with slight effort; requires occasional repetition due to noise or distortion") as defined in NFPA 1221.
- 18. The System and the associated wireless devices shall comply with the FCC and regional regulatory authorities' emission rules for wireless devices.
 - a. Refer to: FCC advisory: "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures, and Practical Guidance", FCC's OET Bulletin 65, FCC Rule 47-part 17 and (ANSI/IEEE C95.1-1992) Hazardous Emission document.

1.4 SUBMITTALS

- A. Comply with Submittal procedural, quantity, and format requirements.
- B. Submittal Requirements with the Bid:
 - 1. Statement of Work that describes the entire proposed scope.
 - 2. Acknowledge that the specified equipment will be installed per design or provide a substitution request letter as outlined.
 - 3. A certificate from the manufacturer of the equipment to be installed stating that the ERRCS installer is trained and qualified on the equipment.
 - 4. An FCC-issued GROL for the lead installation personnel and the testing personnel
- C. Submittal Requirements Prior To Start of Construction:
 - 1. Initial on-site discovery survey report following NFPA 1221 Annex A testing guidelines.
 - 2. Product data submittal
 - 3. Shop Drawings Submittal: Shop drawings shall include the following information:
 - a. Pathway and cable support systems
 - b. Wall and/or rack elevations, showing equipment layout, space requirements and integration with other systems (outside the scope of the ERRCS)
 - c. Installation details for unique antenna mounting conditions, specialty cable hangers, and other components specific to the system not covered under the contract drawings.
 - 4. Compliance by permitting agency.
- D. Submittal Requirements Prior to Acceptance Testing:
 - 1. Test equipment to be used during commissioning that shows current calibrations and test data.

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2. Acceptance Test Plan (ATP): This submittal shall describe in detail the procedure for testing the System's performance and balancing the System's signal strength, including a description of the test data (or an example of the test report). The procedures and results shall demonstrate the desired.

services have been successfully deployed and tested. The ERRCS must be deployed with the FCC Licensee (SRRCS) AHJ criteria and approval.

E. Submittal Requirements at Close Out:

1. As-Built Drawings, including.
 - a. Donor antenna, grounding, and lightning protection details
 - b. Cable routing, splitters, couplers, and coverage antenna locations
 - c. Active component locations, layout, and configuration
2. Letter from the FCC Licensee/AHJ accepting the ATP results.
3. Test Reports
 - a. Cable test results — includes every cable segment sweep.
 - b. Validation survey report Walk Testing-to include heat maps and or grid test results.
4. Operations and Maintenance Manual
5. Warranty Documents
 - a. Submit Contractor's System warranty, including procedures and contact information for service calls under warranty.
 - b. Submit Manufacturer's warranty, including procedures and contact information for service calls under warranty.
6. Integration of components and pathways into the Building Information Model (BIM)

1.5 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements.
- B. Comply with manufacturers' specifications.

1.6 WARRANTY

- A.
 1. Splitters, couplers, and Coverage Antennas: 5-Year limited Warranty from date of system acceptance.
 2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 3. Fiber- Optic Cable: 25-year limited warranty from date of acceptance
 4. Active Components: 1- year limited warranty from date of system installation

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Comba
- B. JMA Wireless
- C. Westell

2.2 SUBSTITUTIONS

- A. Comply with the Substitution requirements.

2.3 ANNUNCIATOR

- A. Displays status of BDA, Donor Antenna, AC Power, Battery Capacity, Battery Charger, and System Status.
- B. Includes a form C relay for interface with fire alarm system
- c. NEMA-4 enclosure

- D. Internal battery back-up
- E. Manufacturer, or equal:
 - 1. DASalert #1221

2.4 TEST EQUIPMENT

A. Specifications

1. Accuracy: ± 1 dB (across basic RF input power range)
2. Dynamic range: -120 dBm to -20 dBm at 30 kHz
3. Frequency range: 150 MHz to 900MHz
4. Technologies: LMR, and P25
5. Connection: Bluetooth or USB to Windows laptop or Android tablet
6. Power: Hot-swappable batteries

B. Manufacturers, or equal:

1. Anritsu MS2720T "or equivalent" spectrum analyzer
2. PCTEL — IBflex
3. Keysight — Nemo
4. FalconSmart — FalconKitt
5. EnhanceCell — Echo
6. Accuver — XCAL
7. Infovista — TEMS

PART 3 EXECUTION

3.1 GENERAL

- #### A. Comply with manufacturers specifications.

3.2 PRE-INSTALLATION AND COORDINATION

- #### A. Coordinate RF rebroadcasting agreements with AHJ.
- #### B. Represent the Owner during negotiations with the FCC Licensee/AHJ to obtain their approval.
- #### C. Examination and Preparation
1. Examine equipment rooms, pathways, power service, NFPA 72 and NFPA 1221 compliance, and other aspects for completeness, the compatibility with the work of this section, and the readiness for connections with the work of this section.
 2. Confirm the enterprise Ethernet network is ready for connection to the System.
 3. Confirm that the fire-alarm system's annunciator is ready for connection to the System.

3.3 PROJECT MANAGEMENT SERVICES:

- #### A. Assign project manager, a single-point-of-contact, to this project with overall responsibility for communications and ultimate delivery of contracted materials, installation, performance criteria, and services. This PM shall be responsible for interfacing with the Owner, AHJ, the General Contractor, and their own subcontractors.
- #### B. Represent the Construction Team to coordinate on-site construction activities with the General Contractor.
- #### C. Close out the project with the Owner.

3.4 INSTALLATION

- #### A. Coordinate the installation and schedule with the Owner, General Contractor and electrical contractor prior to the start of installation activities. Once the Owner and General Contractor have accepted the coordination and schedule, proceed with installation.

- B. Coordinate the location of and power service to a NEMA 4 type cabinet. Anchor the cabinet to the building structure per the project's approved methods.
- C. Install active signal components and battery systems (used for emergency power) in a NEMA 4 type cabinet.
- D. Meet with the Owner to discuss their needs for monitoring the System. Set up the electronic supervisory system (used to monitor signal booster components, emergency power and battery systems) per the Owner's requirements.
- E. Indoor Antenna Installation
 - 1. Mount according to manufacturers' recommendations.
 - 2. Mount at locations identified within ERRCS design drawings. Avoid mounting locations as follows:
 - a. Adjacent to metal materials
 - b. Adjacent to RF signal sources
 - 3. Cable paths to antennas shall match ERRCS design drawings.
 - 4. Deviation of installation details and/or locations must be coordinated with ERRCS design engineer.
- F. Change default passwords in accordance with the Owner's direction.
- G. Install latest software versions, firmware, and security patches.
- H. Disable unused communication ports, protocols and access accounts.
- I. Test the following during installation: Return Loss (RL) and Distance to Fault (DTF) Loads, system
- J. System Balancing: Balance system component (e.g., antenna) signal strength to the device signal levels.
- K. Alert the FCC Licensee prior to bringing the system operational.
- L. Manage FCC License: Acting as a representative of the Owner, obtain required licenses for operation under FCC Regulations.
- M. Do not install amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC without prior coordination and approval by the AHJ.

3.5 LABELING

- A. General Requirements
 - 1. Label equipment, components, and cables.
 - 2. Labels shall be permanent.
 - 3. Text shall be machine-generated; handwritten labels will not be accepted.
 - 4. Labeling, label colors, and identifier assignment shall conform to the TIA-606 standard. Coordinate labeling and identifier assignment with the Engineer or Owner.
 - 5. Submit a labeling plan compliant with the labeling requirements shown in the Technology drawings.
- B. Equipment Labeling
 - 1. Affix labels to equipment (such as fiber remote units) such that they will be clearly visible.
- C. Cable Labeling
 - 1. Affix label as close as practical to each end of each cable.
 - 2. Cable labels shall fully wrap around cable jackets resulting in a self-laminating result.
- D. Antenna Labeling
 - 1. Affix labels to antennas such that they will be clearly visible.

3.6 ACCEPTANCE TESTING / VALIDATION SURVEY

- A. Complete acceptance testing in accordance with the approved Acceptance Test Plan (ATP). Only a qualified person or persons familiar with ERRCS and associated data collection tools shall test the System.

- B. Perform an on-site survey to validate RF coverage (signal strength) throughout coverage areas (listed in Part 1) using approved test equipment.
- C. Testing Procedure
 - 1. Verify that remote units for the area under test are on.
 - 2. Record signal strengths of required frequency bands present at the donor antenna.
 - 3. Each floor of the building shall be divided into a grid of equal test areas.
 - a. Floors with less than or equal to 128,000 sq-ft use a grid of 20 approximately equal test areas between 20 to 80 ft each.
 - b. Floors with greater than 128,000 sq-ft use equal grids that have a maximum of 80 ft. It is recommended that the floor be subdivided into sectors each having an area less than or equal to 128,000 sq-ft, and each sector be tested individually with 20 ft grid cells in each sector.
 - 4. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.
 - 5. Downlink received signal level will be recorded in the coverage area using a continuous wave test signal. Measurements will be collected using a spectrum analyzer and a dipole antenna.
 - 6. Signal strength and link spectrum: Must meet or exceed all critical areas and less than nine nonadjacent and/or six adjacent cell failures.
 - 7. DAQ: Must meet or exceed all critical areas and not more than two non-adjacent grid cells failures. If two adjacent areas fail the DAQ test, then grid should be halved and retested with no *more* than eight nonadjacent and/or five adjacent cell failures
- D. Equipment Requirements
 - 1. Testing equipment must be calibrated within the past 12 months.
 - 2. Allow test equipment to stabilize in the test environment prior to calibration for a minimum of thirty minutes. Changes in temperature can void the calibration.
 - 3. Verify that all remote units for the area under test are ON.
 - 4. Test frequency and power measurements shall be time stamped.
 - 5. Use a spectrum analyzer to capture and present signal strength, preapproved by the project engineer.
 - a. Verify the spectrum analyzer is set to unity gain (0dB, frequency specific) so that the combination of analyzer and its antenna do not artificially increase measurement results.
 - b. Present signal strength as a graphical "heatmap".
 - 6. Site walk screen shots shall be saved with frequency span +/- 20 MHz relative to the center / measured frequency.
- E. Documentation
 - 1. Exact location of measurement must be marked on the gridprint.
 - 2. Screen shots must be taken in all designated grid spaces. If more than one reading is saved per grid zone, saved results shall be distinguished from one another using Grid# "A", Grid# "B", etc.
 - 3. Produce a validation survey report documenting the results including heat maps of the following:
 - a. Signal strength (RSSI)
 - 4. Report testing results to the project engineer for analysis.

3.7 FINAL INSPECTION

- A. Participate in a punch walk with the engineer to demonstrate that the work complies with the requirements of this section.
- B. Submit Certificate of Compliance with manufacturers specifications.
- C. Submit final testing documentation to and obtain acceptance from the AHJ. Include these documents in the as-builts.

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3.8 TURNOVER AND TRAINING

- A. Pre-emptive Maintenance Minimum Requirements: Perform the following just prior to closeout.
 - 1. Clean filters, vents, and equipment components that may accumulate dust and dirt.
 - 2. Organize and manage cables and cords that have been placed.
 - 3. Update firmware with latest versions.
 - 4. Document and photograph any conditions that may affect the continuing function and long-term operation of the System and report to Owner.
- B. Present the completed system and wireless services to the Owner, including functionality, features, ongoing maintenance, and warranty procedures. Demonstrate to Owner and engineer, system operation, including signal strength at selected locations. Turnover at least one set of both electronic and printed records, per the Owner's request.
- C. Comply with training requirements of section 270000. For this System, provide up to 8 hours of training for the Owner.

3.9 WARRANTY PERIOD MAINTENANCE

- A. Correct deficiencies within 24 hours of notification during the warranty period.

3.10 EXTENDED SERVICES

- A. Submit costs for extended services (additional service levels beyond the warranty period) as follows:
 - 1. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and same-day issue response
 - 2. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 24-hour issue response
 - 3. One-year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 48-hour issue response

END OF SECTION

SECTION 28 10 00
ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of complete installation and integration to control the physical security and access to UCDH buildings.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. Access control is an integral part of the UCDH Campus Security program. This system shall provide security for staff and students to freely but securely enter buildings under a controlled access policy.
- B. UCDH has standardized on the Lenel OnGuard access control system. UCDH shall provide and install Lenel OnGuard Professional software and licensing. Contractor shall provide and install access control hardware and program to interface to the existing access control server and cardholder database.

1.3 SEISMIC DESIGN REQUIREMENTS

- A. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16A. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- B. Supports for such items, including racks and rack cabinets, conduit, cable trays and similar, shall be provided support, bracing, and anchorage designed by the Contractor in accordance with the following criteria:
 - 1. Design to resist seismic forces in accordance with CBC Chapter 16A.
 - 2. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, and Spectral Response Acceleration.

1.4 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS

- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 20 00 VIDEO SURVEILLANCE
- E. 28 31 00 INTRUSION DETECTION

1.5 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020

- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/UL 294 Standard for Access Control System Units, 2018

1.6 SUBMITTALS

- A. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- B. Develop a Facility Access Control Plan in accordance with the UCDH Campus Security program.
 - 1. Include exterior doors, perimeter doors, and vertical transportation including stairs and elevator floor access for staff and general public.
 - 2. Develop interior access control zoning plan by floor, suite, and individual room.
 - 3. Include coordination with the project construction management for differences in the access control plan during construction and after completion of construction.
 - 4. Compile the access control plan, including color-coded graphics and diagrams, in Adobe Acrobat or Bluebeam Revu and submit an electronic copy in .pdf format.
- C. Submit product data submittals to UCDH for review and approval.
 - 1. Submit product data submittals system, product, device, and equipment product data cutsheets.
 - 2. Manufacturer's published cutsheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided.
 - 3. Mark cutsheets to indicate the associated Section.
 - 4. Contractor's lead technician shall be a Lenel Certified Professional in Access.
 - a. Provide documentation of Contractor's factory-trained and authorized service representatives.
 - 5. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in Adobe Acrobat or Bluebeam Revu complete with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.
- D. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.

7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, reception station, or other location, where applicable.
8. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.

E. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.

1. Prepare O&M manual in 8-½" × 11" letter size sheet format, labeled, grouped, and ordered, with bookmarks as indicated in a Table of Contents.
2. Include manufacturer's system and product data sheets, operation and maintenance information, troubleshooting and servicing instructions, routine maintenance instructions, and copies of all programming sheets.
3. Provide a copy of the final approved acceptance testing reports and documentation.
4. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
5. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.

F. Submit as-built drawings submittals to UCDH for review and approval.

1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Contractor must be a Lenel VAR in good standing.

1.8 WARRANTY

- A. Access control hardware products and components shall be covered by the manufacturer's warranty for a minimum of two years from date of UCDH acceptance of the project.
- B. Maintenance and repair service shall be available locally and within four hours of notification for emergency conditions.

- C. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL PRODUCTS

A. Access Control Panels

1. Intelligent system controllers serve as the primary communication devices between the access control system software and the individual door controllers and card readers. The Intelligent system controller provides decision-making, event reporting, and database storage for access control system field devices and card numbers.
2. Performance Criteria: Intelligent system controllers must have and be configured to utilize the following capabilities:
 - a. Provide data encryption for all data stored at rest within the controller
 - b. Provide data encryption for all data when in transit to and from the UCDH networks
 - c. Provide data encryption for all data when in transit to and from associated door controllers and card readers
 - d. Communicate with the access control system server via on-board 10-BaseT/100Base-TX Ethernet port
 - e. Provide secure encrypted communication to downstream door controllers and input/output boards via either of two SIO 2-wire RS-485 communication ports; card readers configured to utilize OSDP version 2 with Secure Channel
 - f. Include two digital inputs to monitor access control panel enclosure tamper switch and AC power fail monitoring
 - g. Power: 12-24VDC
 - h. Dimensions: 6"L by 5"W by 1"H
3. Intelligent system controller:
 - a. LNL-X3300 (Default Controller model)
 - b. LNL-X2220 (Alternate Controller model)
 - c. Series X3

B. Access Control Input Boards

1. Provide input boards at intelligent system controller locations for alarm device and I/O interfaces.
2. Input board:
 - a. LNL-1100
 - b. Series X3

C. Access Control Output Boards

1. Provide output boards at intelligent system controller locations for alarm device and I/O interfaces.
2. Output board:
 - a. LNL-1200

- b. Series X3

D. Access Control Reader Interface Boards

1. Reader interface boards serve as the primary communication devices between the intelligent system controller and the card reader.
2. Performance Criteria: Reader interface boards must have and be configured to utilize the following capabilities:
 - a. Provide data encryption for all data stored at rest within the reader interface board
 - b. Provide data encryption for all data when in transit to and from associated intelligent system controller and card readers
 - c. Support OSDP Secure Channel technology for communication to card readers
 - d. Communicate to intelligent system controller via SIO 2-wire RS-485 communication
 - e. Power: 12-24VDC power
3. Reader interface board:
 - a. LNL-1300
 - b. LNL-1320
 - c. Series X3

E. Access Control Card Readers

1. Card readers serve as the primary communication devices between access control cards and the reader interface boards.
2. Performance Criteria: Card readers must have and be configured to utilize the following capabilities:
 - a. Support the ability to read and process HID iCLASS SEOS credentials
 - b. Support the ability to read and process HID Mobile Identity credentials
 - c. Support OSDP version 2 Secure Channel technology for communication to reader interface boards
 - d. Support Bluetooth/NFC communication technology for utilization with mobile credentials
 - e. Powered via reader interface boards
 - f. Including an autotuning feature to maximize and normalize signal strength
 - g. Utilize pig-tail wiring for connection to cabling
 - h. Provided with a standard mounting plate and black cover
 - i. Display no LED when the associated door is secure, and the card reader is ready to accept an access attempt
 - j. Provide an audible beep upon each card read
 - k. Display a solid green LED upon a valid card read that stays on for a fixed duration. (until the unlock time expires.)
 - l. Display a red LED upon invalid card read
 - m. Display a steady green LED when the door is unlocked via a time schedule
 - n. Provided in form factors that match existing reader mounting hardware and installation configurations

3. Card readers – mullion mount
 - a. HID Signo, model 20, part number 20NKS-02-000000
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. Dimensions - 1.77" x 4.78" x 0.77"
 4. Card readers – mullion mount with keypad
 - a. HID Signo, model 20K, part number 20KNKS-02-000000
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. 2x6 backlit keypad
 - d. Dimensions - 1.78" x 4.79" x 0.85"
 5. Card readers – wall mount
 - a. HID Signo, model 40, part number 40NKS-02-000000
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. Dimensions – 3.15" x 4.78" x 0.77"
 6. Card readers – wall mount with keypad
 - a. HID Signo, model 40K, part number 40KNKS-02-000000
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. 3x4 backlit keypad
 - d. Dimensions – 3.16" x 4.79" x 0.85"
- F. Lock Power Supply Panel
1. Lock power supply shall be complete with enclosure and two 12VDC, 7Ah, sealed batteries, connected in series, to supply 24VDC.
 2. Power supply shall include expansion capability, and ability to accept dry contact interface from fire alarm system to initiate power shutdown to "Fail Safe" electrified lock hardware.
 - a. Altronix AL600ULM
- G. Magnetic Door Contact
1. Flush concealed mounted in door frames and doors.
 - a. GE/Sentrol 1076C
 - b. Or approved equal
- H. Request-To-Exit Motion Detector
1. Mounted above access controlled doors on egress side of door.
 - a. Detection Systems DS-150i
- I. Door Alarm Sounder
1. Provide door alarm sounders where indicated on Drawings.
 - a. System Sensor PA400W Mini-Alert Sounder
 - b. System Sensor MHW Mini Horn
 - c. Or approved equal

2.2 DOOR HARDWARE PRODUCTS

- A. Electrified locking hardware installed on labeled fire door assemblies shall be installed without altering the rating of the fire door assembly. If a door is cored in the field for a door-mounted electrified door lock, the work shall be performed, and the fire door assembly shall have a new rating label applied, by a Nationally Recognized Testing Laboratory (NRTL) certified Contractor.
- B. Electric Strike
 - 1. Provide electric strike, non-handed, and constructed of stainless steel. The electric strike shall have the ability to accept locksets with $\frac{3}{4}$ " throw latch bolt. The solenoid shall be rated for continuous duty, 24VDC powered for silent operation. The unit shall meet all standards and shall be UL listed.
 - a. Von Duprin 6200 Series
 - b. Or approved equal
- C. Magnetic Lock
 - 1. Provide electromagnetic lock which meets ANSI/BHMA A156.23 for the minimum holding force of 1500 LBF.
 - a. Locknetics MagForce+ Series
 - b. Or approved equal
- D. Electrified Exit Device
 - 1. Provide electrified exit device, shall be non-handed and constructed of stainless steel; it shall require no more than 15 pounds of force to operate. Additional functionality requirements
 - 2. Electrified exit devices shall internally provide request-to-exit function
 - 3. Fire alarm and auxiliary lock functionality
 - a. Von Duprin 99 series
- E. Delayed Egress Exit Device
 - 1. Provide code-compliant delayed egress where indicated on Drawings.
 - 2. Available on all 98/99 Series, XP98/99 Series, and 33A/35A Series electrified exit devices
 - a. Von Duprin CHEXIT Delayed Egress System
- F. Electric Power Transfer
 - 1. Electric power transfer provides a means of transferring electrical power from a door frame to the edge of a swinging door. The units are completely concealed when the door is in the closed position, and are ideally suited for installations involving abuse or heavy traffic.
 - 2. Ten 24-gauge conductors
 - 3. UL Listed for use on fire doors
 - 4. Coordinate door and frame preparation with Division 08 door hardware contractor.
 - a. Von Duprin EPT-10
- G. Electrified Lockset
 - 1. Provide electrified locksets with lever handles.

- a. Schlage ND Series Grade 1 Cylindrical Lock

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Card reader access controlled doors shall be "Fail Secure" unless required by code, authorities having jurisdiction, or as otherwise shown on Drawings to be "Fail Safe".
- D. Card reader access controlled doors are access controlled in the ingress direction. Card reader access controlled doors shall always allow free egress in the egress direction without special knowledge, effort, or the use of a key.
- E. Coordinate with elevator vendor for elevator to integrate into the card access system. Validate travelers are sufficient for the installation to support the card access reader installation within the cab.
- F. Coordinate with Division 08 door hardware contractor:
 - 1. Locking Door Hardware and Accessories
 - 2. Keying
 - 3. Electrified Exit Devices and Power Supplies
 - 4. Door Closers
- G. Coordinate communications infrastructure with UCDH:
 - 1. Telecommunications Room (TR) Equipment
 - 2. Ethernet Connections
 - 3. IP Addresses
 - 4. Network Cabling
- H. Consideration for the following items shall be included in a typical installation:
 - 1. ADA Accessibility Requirements
 - 2. Elevator Interface / Cabling to Elevator Equipment Room
 - 3. Fire Relay Interface
 - 4. Overrides / Keypads
 - 5. Card Readers / Reader Stanchions
 - 6. Magnetic Lock Installation
 - 7. Lever Set / Door Coring

8. Exit Device / Power Transfer / Remote Power Supply
9. Independent Pharmacy Systems

3.2 PREPARATION

- A. Review approved Facility Access Control Plan, product data, and shop drawings submittals.
- B. Thoroughly examine installation conditions to verify conformance with manufacturer and technical specification tolerances.
- C. Complete design and verify equipment location placement.
- D. Validate quantity of reader modules, lock power supplies, and batteries to support readers prior to arrival on site.

3.3 INSTALLATION

- A. Install the system in accordance with the requirements of this Section, the approved Facility Access Control Plan, product data, and shop drawings submittals.
- B. Install a fully functional and completely operational access control system as required and approved by UCDH for the project.
- C. Low-voltage power supplies for access control panels and electrified locking door hardware will be installed with a plug pigtail, and connected to a Power Distribution Unit (PDU).
 1. Ensure security low-voltage power supply is connected to a PDU receptacle (5-15) which is connected to a UPS.
 2. Low-voltage power supplies shall not be hardwired to 120VAC.
 3. Confirm with UCDH that a designated PDU is available for the access control panels, all expansions, and locking hardware power supplies.
 4. Provide AC power quick disconnect on all AC powered low-voltage power supplies.
- D. Connect automatic door operators at card reader access-controlled entrance doors.
- E. Confirm 120 VAC power for door hardware power supplies where required for electrified exit devices.
 1. Local power supply for door hardware shall be 120VAC, 60 Hz supplied from the emergency back-up source. Local power supply shall support battery backup.
 2. Local power supply not required for low-amperage electrified exit devices, such as Von Duprin Quiet Latch Retraction (QEL).
- F. Access control panel enclosure and low-voltage power supply enclosure doors must have a minimum of 180-degree swing and maintain clearances to avoid blocking personnel movement within the room. Each Access Controller enclosure door shall be equipped with a cylinder lock, a tamper switch, and a piano-type hinge with welded tamperproof pins.
- G. Card readers shall be installed no more than 12" from strike side of associated door, unless otherwise shown on Drawings.

- H. Card reader installation surfaces shall be validated for proper operational considerations. Provide card reader standoff spacer when mounting directly onto a metal surface.
- I. For card reader installation: Cut off tinned end of card reader wiring pigtails before twisting and connecting with crimp (B) connectors. Tinned end of pigtail only remains if soldering connections.
- J. Make provisions for field wiring to enter the access control panel enclosures and low-voltage power supply enclosures via standard knockouts at the top and sides. Provide sufficiently-sized conduits to allow for future expansion. Provide bushings on all conduit knock-outs and exposed conduit ends.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, and cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1'x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 - 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.

C. Onsite Acceptance Testing:

1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 20 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Create an IP-based, video security surveillance system, providing proper visual coverage and recording as defined by the customer.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- 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 a video surveillance system, including but not limited to:
 - 1. Installation of Owner-Furnished, Contractor-Installed (OFCI) new video surveillance cameras in specified locations.
 - 2. Power as needed (rarely) for camera support in varying installation formats such as Pan Tilt Zoom (PTZ).
 - 3. Provide devices specified in this Section and related Sections if required by project, and not supplied by UCDH.
- B. Install Owner-Furnished, Contractor-Installed (OFCI) new mini-dome video surveillance camera with infrared inside Telecommunications Rooms (TR) on new projects.

1.3 SEISMIC DESIGN REQUIREMENTS

- A. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16A. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- B. Supports for such items, including racks and rack cabinets, conduit, cable trays and similar, shall be provided support, bracing, and anchorage designed by the Contractor in accordance with the following criteria:
 - 1. Design to resist seismic forces in accordance with CBC Chapter 16A.
 - 2. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, and Spectral Response Acceleration.

1.4 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL
- E. 28 31 00 INTRUSION DETECTION

1.5 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017

- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/NECA 303-2019 Standard for Installing and Maintaining Closed-Circuit Television Systems

1.6 SUBMITTALS

- A. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- B. Submit product data submittals to UCDH for review and approval.
 - 1. Submit product data submittals system, product, device, and equipment product data cutsheets.
 - 2. Manufacturer's published cutsheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided.
 - 3. Mark cutsheets to indicate the associated Section.
 - 4. Provide documentation of Contractor's factory-trained and authorized service representatives.
 - 5. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in Adobe Acrobat or Bluebeam Revu complete with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.
- C. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Provide video surveillance camera schedule including camera unique device name and number, type of camera, lens, location, room number, cable, TR, cabling distances, mounting, and all accessories. Indicate intended video surveillance camera field of view. Indicate dedicated camera power supplies, where provided.
 - 7. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 8. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.

9. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- D. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
1. Prepare O&M manual in 8-1/2" × 11" letter size sheet format, labeled, grouped, and ordered, with bookmarks as indicated in a Table of Contents.
 2. Include manufacturer's system and product data sheets, operation and maintenance information, troubleshooting and servicing instructions, routine maintenance instructions, and copies of all programming sheets.
 3. Provide a copy of the final approved acceptance testing reports and documentation.
 4. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 5. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- E. Submit as-built drawings submittals to UCDH for review and approval.
1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 5. Include final updated video surveillance camera schedule including camera unique device name and number, type of camera, lens, location, room number, cable, TR, cabling distances, mounting, and all accessories. Include video surveillance camera field of view. Indicate dedicated camera power supplies, where provided.
 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 8. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Equipment and accessories furnished under this Section shall be the standard products of manufacturers regularly engaging in the manufacture of this type of product for a period of at least three years.
- C. The manufacturer shall guarantee the availability of parts for a minimum of three years from date of shipment.
- D. The system shall be installed by a factory-trained and certified technician.

1.8 WARRANTY

- A. Warranty workmanship and all material for a period of one year from the date of the installation and acceptance by UCDH.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE PRODUCTS

- A. Video Surveillance Cameras
 - 1. Owner-Furnished, Contractor-Installed (OFCI)
 - 2. High Definition PoE Cameras
 - 3. Shall be compatible with the current UCDH video surveillance system and specified per location by UCDH. Current standard are Axis cameras or similar.
 - 4. Indoor fixed cameras shall be surface-mount or flush ceiling mount.
 - 5. Outdoor fixed cameras shall be housed in a vandal-resistant housing.
 - 6. Cameras shall have remote focus and remote zoom capability.
 - 7. Contractor shall inquire/determine if supporting network switch is POE-capable.
 - a. If supporting network switch is not POE-capable, contractor shall provide and install 1 (one), POE-injector per camera, or multiple-camera injector, as needed.
- B. Camera Power Supplies
 - 1. Camera power supplies, where required (PTZ cameras), shall be Contractor-Furnished, Contractor-Installed (CFCI).
 - 2. Provide/install as needed.
 - 3. Contractor shall size wire gauge and power supply units in order to ensure sufficient power to each camera. (PTZ cameras).
- C. Camera Enclosures and Mounting Accessories
 - 1. Contractor-Furnished, Contractor-Installed (CFCI)
 - 2. Owner shall provide a complete list of cameras to be provided.
 - 3. Contractor shall provide mounts, brackets, flush-mount kits, pendants, adapters, etc. as needed to suit the installation conditions, to produce the intended view.
- D. Network Video Recorder (NVR)
 - 1. Owner-Furnished, Contractor-Installed (OFCI)
 - 2. NVR shall be specified by UCDH. Current standard is Razberi.
- E. Video Management System
 - 1. Cameras shall be compatible with the existing UCDH Video Management System, Qognify Ocularis (formerly OnSSI).
- F. Miscellaneous

1. Media converters, Ethernet extenders, Camera Power Supplies, Pan-Tilt-Zoom (PTZ) camera equipment, and other equipment not specified, but required for the project to meet special and/or unusual applications, shall be submitted in writing to UCDH for approval.

G. Network Cable

1. Refer to the requirements of Division 27 Communications Sections.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Network cable and patch cables for cameras shall be provided in accordance with the requirements of Division 27 Communications Sections.
- D. Exterior cameras shall be IP66 rated for outdoor installation.

3.2 PREPARATION

- A. Contractor shall proactively initiate the planning, communication, and preparation for site visits and installation, including distribution of, and schedule for installation work, with project and UCDH representatives.
- B. Contractor shall request IP addresses in advance of the need.
- C. Thoroughly examine installation conditions to verify conformance with manufacturer and technical specification tolerances.
- D. Validate intended site views prior to camera installation. Contractor and UCDH representative to walk jobsite and view every camera location.
- E. Validate cable parameters and operational status to server(s).
- F. Validate network equipment and capacity, licensing, and firmware with UCDH.
- G. Coordinate Power over Ethernet (PoE) network switch requirements with UCDH.

3.3 INSTALLATION

- A. Contractor to test network cable before installing camera.

- B. Contractor shall install and configure initial camera field of view and focus for confirmation by UCDH representative. Refocus and fine tune camera field of view and focus with UCDH representative present for approval.
- C. Contractor shall program initial camera settings such as resolution and frame rate for live and recorded video for confirmation by UCDH representative. Configure video data storage per UCDH requirements (Camera, Server, Enterprise).
- D. Configure camera bandwidth utilization and codec compression as required by UCDH standards.
- E. Program camera with IP address provided by UCDH.
- F. Label MAC address on camera base during installation.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1"x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.

3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.

C. Onsite Acceptance Testing:

1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 31 00
INTRUSION DETECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of the complete installation and integration of a building Intrusion Detection System.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. The Integrated Digital Alarm Communicator System (DACS) includes but is not limited to:
 - 1. Alarm Control Panels
 - 2. Alarm Keypads
 - 3. Panic and holdup sensors
 - 4. Motion and Glass break Detection
 - 5. Door sensors
 - 6. Remote annunciators and bells
 - 7. Other devices required for integration with Access Control System
 - 8. Engineering, provision, coordination, installation, termination, testing and documentation of alarm panel and functions, as required.
- B. The system shall support the integration of the building access system and reporting of intrusion/access monitoring devices to a remote Digital Alarm Communicator Receiver(DACR).
- C. The system shall be modular in nature and will permit expansion in both capacity and functionality through the addition of controllers or sensors.

1.3 SEISMIC DESIGN REQUIREMENTS

- A. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16A. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- B. Supports for such items, including racks and rack cabinets, conduit, cable trays and similar, shall be provided support, bracing, and anchorage designed by the Contractor in accordance with the following criteria:

1. Design to resist seismic forces in accordance with CBC Chapter 16A.
2. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, and Spectral Response Acceleration.

1.4 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL
- E. 28 20 00 VIDEO SURVEILLANCE

1.5 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020

- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/TIA-968 Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network, 2016

1.6 SUBMITTALS

- A. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- B. Submit product data submittals to UCDH for review and approval.
 - 1. Submit product data submittals system, product, device, and equipment product data cutsheets.
 - 2. Manufacturer's published cutsheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided.
 - 3. Mark cutsheets to indicate the associated Section.
 - 4. Provide documentation of Contractor's factory-trained and authorized service representatives.
 - 5. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in Adobe Acrobat or Bluebeam Revu complete with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.
- C. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.

6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 8. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- D. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
1. Prepare O&M manual in 8-1/2" x 11" letter size sheet format, labeled, grouped, and ordered, with bookmarks as indicated in a Table of Contents.
 2. Include manufacturer's system and product data sheets, operation and maintenance information, troubleshooting and servicing instructions, routine maintenance instructions, and copies of all programming sheets.
 3. Provide a copy of the final approved acceptance testing reports and documentation.
 4. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 5. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- E. Submit as-built drawings submittals to UCDH for review and approval.
1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Installation shall be accomplished in a professional manner by qualified personnel.
- C. The manufacturer shall be able to demonstrate the features, functions, and operating characteristics to UCDH.

1.8 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 INTRUSION DETECTION PRODUCTS

- A. Control Panel
 - 1. Bosch Security Systems. Model B9512G, B930 Keypad, and enclosure with door tamper switch.
- B. Keypad / Annunciator
 - 1. Bosch model B930 keypad
- C. Glass Break detectors
 - 1. Honeywell FG-730 with sensitivity adjustment
- D. Motion Detectors
 - 1. Bosch motion detector ISC-BPQ2-W12
- E. Panic/Robbery Switch
 - 1. Potter HUB- M Single Button Hold up switch.
- F. Door Contacts
 - 1. Magnetic door contact, flush – GE/Sentrol 1078 N-C 7/8"
 - 2. Magnetic door contact, flush – GE/Sentrol 1078 N-C 1"
- G. Expansion Modules
 - 1. Bosch B208 Octo-Input Module
- H. Request to Exit (REX)
 - 1. Bosch DS150i
- I. Panel Power Supply
 - 1. Bosch D1640

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.

- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Intrusion detection system enclosure doors must have a minimum of 180-degree swing and maintain clearances to avoid blocking personnel movement within the room.

3.2 PREPARATION

- A. Develop security system plan and complete approval process with UCDH.

3.3 INSTALLATION

- A. Low-voltage power supplies for intrusion detection system equipment will be installed with a plug and connected to a Power Distribution Unit (PDU).
 - 1. Ensure security low-voltage power supply is connected to a PDU receptacle (5-15) which is connected to a UPS.
 - 2. Low-voltage power supplies shall not be hardwired to 120VAC.
 - 3. Confirm with UCDH that a designated PDU is available for the intrusion detection system panels and all expansions.
 - 4. Provide AC power quick disconnect on all AC powered low-voltage power supplies.
- B. Installation shall be accomplished in a professional manner by qualified personnel.
- C. Install a fully functional access control system as required and approved by UCDH for the project.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1"x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.

2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.

B. System Functional Testing:

1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.

C. Onsite Acceptance Testing:

1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 31 00.01**FIRE DETECTION AND ALARM SYSTEM****ENGINEERING SPECIFICATION
INTELLIGENT REPORTING FIRE DETECTION SYSTEM****PART 1 GENERAL****1.1 DESCRIPTION**

- A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- B. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994
- C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.
- D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- E. The installing company shall employ NICET (minimum Level II Fire Alarm System) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 GUARANTY:

- A. The undersigned guarantees to the Owner, that he will be responsible for faulty materials, equipment and workmanship, and that he will remedy any defects thereto, and pay for any damage to other work resulting there from, which shall appear within a period of one (1) year from the date of final system acceptance test.

1.4 POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a minimum period of five (5) years after expiration of the guaranty.
- B. As part of the project closeout, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Also include a quote for unscheduled maintenance/repairs, including hourly rates for

technicians trained on this equipment, and response travel costs for each year of the maintenance period. Rates and costs shall be valid for the period of one (1) year after expiration of the guaranty.

1.5 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
- B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 72	National Fire Alarm Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 101	Life Safety Code

- C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No. 60950	Safety of Information Technology Equipment

- D. Local and State Building Codes.
- E. All requirements of the Authority Having Jurisdiction (AHJ).

1.6 APPROVALS:

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories, Inc
FM	Factory Mutual
CSFM	California State Fire Marshal

PART 2.0 PRODUCTS

2.1 Main Fire Alarm Control Panel or Network Node:

- A. Main FACP or network node shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 System Capacity and General Operation

- A. The FACP shall have the capabilities of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.
- B. The control panel shall have the capabilities of expansion of up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points.
- C. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
11. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
12. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
13. Block Acknowledge: The system shall support a block Acknowledge for Trouble

Conditions

14. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
15. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
16. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
17. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
18. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
19. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
20. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.
21. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well as display a FIRE CONTROL Type Code and other information specific to the device.
22. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
23. Security Monitor Points: The system shall provide means to monitor any point as a type security.
24. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equa

tions. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

25. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
26. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
27. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
28. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
29. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
30. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
31. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
32. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

E. Network Communication

1. The FACP shall have the capabilities of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall sup

port communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal,

alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

J. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. It shall be possible to program through the standard FACP keyboard all system functions.
3. All field defined programs shall be stored in non-volatile memory.
4. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
5. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
6. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

K. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

L. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
 - a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Analog Detector Sensitivity.
 - g. All Program Parameters.
4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.3 SYSTEM COMPONENTS:

A. Communicators

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status
 - c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault
 - e. System Off Normal
 - f. 12 and 24 Hour Test Signal
 - g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

2.4 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be

- capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
 3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
 4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
 5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
 6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
 7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
 8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
 9. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
 10. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
 11. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
 12. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
- B. Addressable Manual Fire Alarm Box (manual station)
1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual

- emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-951 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
- D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST-series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.
- E. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-951R.
- F. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
 2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
 3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
 4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.
- G. Addressable Control Module
1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

H. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

I. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

J. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

K. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. . The repeater shall be UL864 approved.

3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

L. Notification Appliances

6. Notification appliances shall be System Sensor horn/strobes and strobes for occupant notification.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

END OF SECTION

SECTION 28 49 00
ELECTRONIC PERSONAL PROTECTION 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 a Healthcare Patient Security (HPS) system.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. The HPS shall be designed to monitor tagged patients and alarm on unauthorized movement of infants, pediatric, or adult patients from protected areas. The system shall report violations of restricted passage to and from areas being monitored in order to generate an appropriate staff response.
- B. When patients are admitted to a protected area, a monitoring tag shall be physically attached to the patient. Then, the monitoring tag shall be configured in software, with parameters specific to that patient and area. The monitoring tag shall be continuously monitored by the system software, to validate the appropriate location of the patient. When a tag is attached to a patient and admitted, an auto-admit signal shall be sent to the Server through a system Receiver. A tag description shall be entered at any dedicated workstation to identify the patient, along with the pre-determined zone ID, representing the physical area where the patient is to be monitored. While active, the tag shall transmit a "heartbeat" every 10 seconds, monitored by the Controller system software. If the heartbeat is not detected within a specified amount of time the system shall alarm. If the tag or band is tampered with, the tag shall alarm.
- C. Perimeter areas shall be established that monitor patient traffic and differentiate monitored patients versus allowed foot traffic. UCDH representatives shall determine how the system reacts and alarms to unauthorized patient travel
- D. The HPS system shall establish a "Safe Zone" within each protected Nursing Suite, within a particular building. A "Safe Zone" establishes a perimeter, through which a monitored patient is not allowed, without proper authorized Staff escort. Refer to the Drawings and Bid Instructions to determine the scope limitations for this work.
- E. HPS Server: The HPS (virtual) Server shall be located in the designated Data Center, per the Drawings and Bid Instructions. System management e.g. User definition, patient identification, workstation configuration, and system configuration, device installation and alarm monitoring history shall be stored in the system database at this location. The HPS Server interfaces with system hardware on each monitored Nursing suite, via network interfaces, installed at each suite..

- F. Patient Security Monitoring Locations (Workstations): Additional patient security monitoring workstations are provided for monitoring tags and system alarms in real time. Workstations shall be installed at Nurse Stations and other specified locations. (See Drawings and Bid Instructions.)
- G. Patient Tag Registration: Patient tag registration shall occur at the Reception desk and all Nursing Stations, within the "Safe Zone" within each protected Nursing Suite. Login/Password authentication is required prior to tag configuration.
- H. Tag alarm management shall be the responsibility of Nursing Staff, within each monitored Nursing Suite.

1.3 SEISMIC DESIGN REQUIREMENTS

- A. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16A. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
- B. Supports for such items, including racks and rack cabinets, conduit, cable trays and similar, shall be provided support, bracing, and anchorage designed by the Contractor in accordance with the following criteria:
 - 1. Design to resist seismic forces in accordance with CBC Chapter 16A.
 - 2. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, and Spectral Response Acceleration.

1.4 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL
- E. 28 20 00 VIDEO SURVEILLANCE
- F. 28 31 00 INTRUSION DETECTION

1.5 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)

- G. Telecommunications Industry Association (TIA)
 - H. Underwriters Laboratories, Inc. (UL)
 - I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
 - J. Public Safety (California Code of Regulations, Title 19), 2021
 - K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
 - L. NFPA 70 National Electrical Code (NEC), 2020
 - M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
 - N. NFPA 99 Health Care Facilities Code, 2021
 - O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
 - P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
 - Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
 - R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
 - S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
 - T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
 - U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
 - V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
 - W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- 1.6 SUBMITTALS
- A. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
 - B. Submit product data submittals to UCDH for review and approval.
 - 1. Submit product data submittals system, product, device, and equipment product data cutsheets.
 - 2. Manufacturer's published cutsheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided.
 - 3. Mark cutsheets to indicate the associated Section.

4. Provide documentation of Contractor's factory-trained and authorized service representatives.
 5. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in Abode Acrobat or Bluebeam Revu complete with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.
- C. Submit shop drawings submittals to UCDH for review and approval.
1. Submit shop drawings submittals including device and equipment locations.
 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 4. Indicate wall space and rack space requirements.
 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 6. Indicate and label access controlled zones and electronic personal protection system secure zones.
 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station.
 8. Include user defined information per floor and per system component.
 9. Local Area Receivers (LAR) and Portal Exciters shall be accurately located on the shop drawings graphically indicating the diameter of the Local Area Receivers (LAR) coverage areas and the Portal Exciter coverage areas at the associated door.
 10. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- D. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
1. Prepare O&M manual in 8-½" × 11" letter size sheet format, labeled, grouped, and ordered, with bookmarks as indicated in a Table of Contents.
 2. Include manufacturer's system and product data sheets, operation and maintenance information, troubleshooting and servicing instructions, routine maintenance instructions, and copies of all programming sheets.
 3. Provide a copy of the final approved acceptance testing reports and documentation.
 4. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 5. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Abode Acrobat or Bluebeam Revu .pdf format.
- E. Submit as-built drawings submittals to UCDH for review and approval.
1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.

5. Indicate and label access controlled zones and electronic personal protection system secure zones.
6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station.
7. Local Area Receivers (LAR) and Portal Exciters shall be accurately located on the as-built drawings graphically indicating the diameter of the Local Area Receivers (LAR) coverage areas and the Portal Exciter coverage areas at the associated door.
8. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and of current manufacture.
 1. Tags shall be provided with long-life batteries. Batteries shall be guaranteed to have a minimum one (1) year active life (tag performance shall show no signs of significant performance degradation for 1 year from the date of first-time enrollment). Tag battery expiration date shall be clearly and indelibly printed on the tag, where it may be readily viewed, without disturbing the patient or tag placement.
 2. All PCs, Server (if provided), and other, system-related durable electronic appliances shall be warranted by the Contractor for a period of at least one year from date of acceptance.
 3. All system-related, durable electronic equipment shall be warranted by the Contractor, for a period of at least one year from date of final acceptance. In the event of equipment failure, the Contractor shall provide replacement equipment, including parts, any required mounting hardware, and installation labor, for the period of one (1) year from the date of final acceptance. Further, Contractor shall either 1. Provide spare equipment to UCDH, for replacement use, or 2. Keep sufficient spare equipment on-hand, in new condition and specifically designate said equipment for use on UCDH site, in case of equipment failure. Spare parts and equipment costs may be included in Contractor's original bid package. Bid package must include type and quantity of each spare part and/or piece of equipment and be specified on individual line items.
 4. The Contractor shall guarantee all wiring, terminations and connections, free from inherent mechanical and electrical defects for a period of one (1) year from the date of Final Acceptance by authorized UCDH personnel. Warranty service shall be provided within four hours' notice. If the problem cannot be corrected at that time a written plan of correction with a projected time schedule for completion shall be submitted to authorize UCDH personnel at that time.
 5. Upon completion of system verification, Contractor shall submit a point-by-point checklist, indicating the date and time of each item inspected. Contractor shall furnish authorized UCDH personnel a System Certification of Inspection and Function, signifying that the system adheres to all contractually agreed requirements.
 6. Prior to submitting a request for payment, based upon substantial completion, Contractor shall provide a written test report from an authorized representative of the equipment manufacturer, certifying that the system has been 100% tested and approved.
 7. A UCDH representative shall be present during final testing of all system components and shall certify that the system meets or exceeds system technical specifications and the requirements of this Section. Any and all failures shall be corrected and retested at Contractor's expense, in the presence of UCDH personnel, to verify corrections.

8. Where needed, Contractor shall provide eight hours of use and operational training for the number of personnel specified by Auxiliary Services. Training can be spread over multiple days, if so agreed-upon in writing.
 9. Provide 24 hour/7days per week of technical support from an employee of the HPS system manufacturer, or their designee, for initial programming and startup, and for a period of not less than 90 days after final system acceptance.
- B. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years.

1.8 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 DEVICES

- A. General
1. Patient Security Receiver (PSR): Shall be system software and hardware-compliant, currently manufactured equipment, in new, unused condition.
 2. Portal Exciters, Portal Exciter Slaves, and Portal Exciter Range Extenders: Shall be system software and hardware-compliant, currently manufactured equipment, in new, unused condition.
 3. System: HPS system software configured by UCDH personnel, as required herein.
- B. Software
1. Executive: Server and client software
 2. Custom/User: Software and programming as required to include all alarm, map, and database functions described herein
- C. Workstations
1. Provide workstation PC, as shown on the Drawings. The following describes the minimum guideline configuration for workstations: Contractor shall be responsible for ensuring the acceptable performance of the system based upon the HPS manufacturer's hardware requirements and the performance criteria specified herein for the patient security.
 2. HPS workstations and monitoring devices shall report directly to the HPS Server.
 3. HPS communication Network: for a supervised network shall provide communication between monitoring Patient Security Receiver (PSR), Portal Exciter units and the ILON appliance, from each monitored Nursing Suite.
 4. Client Workstation: Workstations and video monitors shall meet computer workstation technical specifications in effect at the time of request.
- D. HPS Devices
1. Provide Patient Security Receiver (PSR) and Portal Exciters, in sufficient quantities, to meet manufacturer's recommendations. Contractor shall ensure the provision of a complete system, and provide sufficient labor hours to test the system, after it is installed.

Further, Contractor shall remediate all malfunctions of equipment and/or cabling, discovered for a period of one year from acceptance date. Contractor shall provide trained, emergency response personnel, on a 24-hour, 7 days/week basis for the period of one year from acceptance. Personnel shall respond to emergency calls within 4 hours of initial contact.

E. Patient Security Receiver (PSR)

1. Provide open area reception. Quantity shall be as required to provide complete coverage on the designated floor. Each LAR includes,
2. Frequency: Per manufacturer's specs
3. Bandwidth: Per manufacturer's specs
4. Detection Radius: 50' (15 meters) overlapping PSRs, 35' (11 meters) PRs maximum, depending on site conditions
5. Communications: Dedicated network
6. Supervision: Fully supervised, with regular polling by HPS Server
7. Test Procedure: Self-diagnostic, polled by HPS Server
8. Power: 10 to 30 VDC, 100 mA maximum, powered from dedicated power supply
9. Operating Temperature: 32° to 122°F (0° to 50°C)
10. Humidity: 0 to 90% at 70°F (21°C), non-condensing
11. Weight: Approximately 9.2 oz. (260 g)
12. Dimensions: Approximately 5.2" wide x 3.3" long x 1.5" deep. (33 x 84 x 8 mm)
13. Mounting: Hardware to accommodate on-ceiling, surface mounting

F. Portal Exciter

1. Provide Portal Exciter for protection at each designated entry/exit location. Quantity shall be as required to provide sufficient coverage of all entry/exit locations. The Portal Exciter shall initiate an alarm when patient's tag is sensed passing through its respective RF field, unless the tag is designated to be on transport, prior to exit.
2. Coordinate with UCDH on the normal status of locks at each Portal Exciter location. Provide door position switch alarm contact at each Portal Exciter location (two for double doors), to monitor the open or closed position of the door.
3. Antenna
4. Dedicated Lonworks network interface
5. Frequency: Per manufacturer's specs
6. Bandwidth: Per manufacturer's specs
7. Operating Range: Approximately 30' radius
8. Detection Range: Adjustable up to 8.5 feet (2.6m)
9. Supervision: Fully supervised, with regular polling by HPS Server
10. Test Procedure: Self-diagnostic, polled by HPS Server
11. Power: 10 to 30 VDC, 200 mA @ 24 V DC, 500 mA maximum
12. Operating Temperature: 32° to 122°F (0° to 50°C)
13. Humidity: 0 to 90% at 70°F (21°C), non-condensing
14. Weight: Approximately 18.7 oz. (530 g)

15. Dimensions: Approximately 14.2" long x 4.9" wide x 2" deep. (360 x 124 x 50 mm)
16. Mounting: Hardware to accommodate wall or ceiling mounting

G. Portal Exciter Extender

1. Provide Portal Exciter range extender to extend the range of the Portal Exciter to cover a large opening, such as a hallway or double door.
2. Antenna
3. Dedicated LonWorks network interface
4. Frequency: Per manufacturer's specs
5. Bandwidth: Per manufacturer's specs
6. Operating Range: Approximately 15' radius
7. Detection Range: Adjustable up to 8.5 feet (2.6m)
8. Supervision: Fully supervised, with regular polling by HPS Server
9. Test Procedure: Self-diagnostic, polled by HPS Server
10. Power: 10 to 30 VDC, 200 mA @ 24 V DC, 500 mA maximum
11. Operating Temperature: 32° to 122°F (0° to 50°C)
12. Humidity: 0 to 90% at 70°F (21°C), non-condensing
13. Weight: Approximately 18.7 oz. (530 g)
14. Dimensions: Approximately 14.2" long x 4.9" wide x 2" deep. (360 x 124 x 50 mm)
15. Mounting: Hardware to accommodate wall or ceiling mounting
16. Input/output Module: Provide Programmable I/O Module to support integration with cameras, locking systems, and audible devices
17. Power Supply: Provide Altronix AL600ULM Power Supply compatible with the field equipment and in the quantity necessary to power system components.
 - a. Provide one power supply for LARs and one power supply for Portal Exciters, per Monitored Nursing Unit.
18. The power supply shall provide 12/24VDC, for distribution to selected system components.
 - a. 6 Amps with 5 individual regulated outputs.

H. Infant Protection Tags

1. Provide HUGS Infant Protection Tag with Baby Sense. Sensor shall be water resistant and shock proof.
2. Infant tags shall be used to monitor the passage through monitored portals and shall continually be monitored for presence and condition. The sensor shall be made of durable material and shall be in a form suitable for attachment to an infants' wrist or ankle.
3. Tags shall be provided with long-life lithium batteries. Batteries shall be guaranteed to have a minimum active life of 1-year.
4. Tags shall provide an alarm indication of low battery voltage.
5. Low battery tags shall be prohibited by system software, to be admitted.
6. Provide infant tags, compatible with the specified PSRs and required operation.
7. Provide Soft Touch Infant Bands suitable for fastening to a patient's wrist or ankle and compatible with HUGS tags.

8. The band shall be tamper resistant, and shall provide the system with a "continuity" check, to ensure its continued presence on the patient. The condition of the strap shall be continuously monitored by the system.
- I. Miscellaneous parts
 1. Provide a sample of each product used in the installation of system as a spare parts crash kit.
 2. Provide a full product list of items that are available for installation with the system at the time of system acceptance.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. The use of wire nuts and crimp type connectors shall not be permitted. Where shielded wire is used it shall be connected to an earth ground at the power supply panel. All data signal wiring shall meet Echelon LonWorks network technical specifications.
- D. No power supply enclosure shall be mounted where it is not readily accessible, the highest connection point shall not be above 8', nor shall the bottom of the panel be below 30".

3.2 PREPARATION

- A. Connect equipment to 20 ampere 120 VAC circuit(s) from the emergency power system.
- B. All equipment shall be listed by Underwriter's Laboratories.
- C. Minimum conduit size for multiple conductor runs shall be ¾". In each control panel 2 empty ¾ conduits shall be installed for future use. These conduits shall be routed to an accessible area above the ceiling or to a location approved by UCDH. Run circuits for AC separate from circuits using DC.
- D. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and technical specification tolerances. Do not commence with installation until all conditions are made satisfactory.
- E. All equipment and material shall be new and not used even for demonstration purposes.
- F. The Infant Security system shall co-exist with the access control system.
- G. Review floor plan for access
 1. Review for camera views

2. Isolate an area where foot traffic can be controlled
3. Determine square footage
4. Locate Patient Security Receivers (PSRs) and Portal Exciters

3.3 INSTALLATION

- A. Equipment shall be installed in accordance with manufacturer's recommendations.
- B. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years and specifically trained to install Stanley Healthcare HUGS systems.
- C. Bundle system conductors with nylon cable straps. General: All Cables installed in ceiling spaces shall be rated for plenum use.
- D. Conduct ongoing local and remote diagnostic tests and validations as work progresses.
- E. Controller Cable: Belden 9940, or equivalent, or as recommended by the manufacturer to ensure performance.
 1. 2-wire alarm cable: Belden 8761, or equivalent as recommended by the manufacturer to ensure performance.
 2. 4-wire alarm cable: Belden 9302, or equivalent as recommended by the manufacturer to ensure performance.
 3. Electric Lock cable: Belden 8461, or equivalent as recommended by the manufacturer to ensure performance.
 4. All wiring shall run continuous from device to device. No splices shall be permitted. The use of wire nuts and crimp type connectors shall not be permitted. Where shielded wire is used it shall be connected to an earth ground at the power supply panel. All data signal wiring shall meet Echelon LonWorks network technical specifications.
 5. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1"x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION/ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system

is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.

1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.

B. System Functional Testing:

1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.

C. Onsite Acceptance Testing:

1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

3.6 DEMONSTRATION AND TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate and train UCDH maintenance personnel as described below.
- B. Train UCDH personnel in the procedures and schedules involved in operating, troubleshooting servicing, and preventive maintenance of the systems. Provide a minimum of 16-hours training. Training shall be scheduled in more than one session, as agreed-upon by Contractor and UCDH.
- C. Train UCDH personnel in proper use of the system. Periods of training shall be coordinated with the UCDH representative to assure all nursing shifts receive the required training. Each session shall include instructions utilizing hands-on operation of the HUGS equipment in a typical system as selected by the staff. Provide handout material describing system features and functions to all who attend. Schedule all training through the UCDH representative a minimum of 14 days in advance.

- D. Provide on-site assistance in adjusting sound levels and adjusting controls to suit actual occupied conditions on an as-requested basis for the first year of operation.
- E. A failure of any test or any component during a test will require a complete retest program at no additional cost to UCDH.

END OF SECTION