### DIVISION 1 – GENERAL REQUIREMENTS

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### DIVISION 14 – CONVEYING SYSTEMS

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PART 1 – GENERAL

The Medical Records Refurbishment project is located within the Medical Records building. This building is an operating office-staff building where employees are working. This is a non-OSHPD job. Overview of the job scope is to renovate the vacant interior sections of the building and upgrade the data cabling in the entire building. The main scope of work includes, but is not limited to, soft demolition, interior framing, finish carpentry, doors and frames, flooring, finishes, ceiling tile replacement, signage, lighting, electrical, low voltage cabling, and mechanical.

The work of this contract is divided into multiple phases. See Exhibit 2 – Coordination Reference Drawings and Exhibit 7 – Reference schedule, that includes, but not limited to, the phasing and work required for this project. There are 4 main quadrants of the project. The 4 quadrants include 1st floor north (1N), first floor south (1S), 2nd floor north (2N), and 2nd floor south (2S). Work of these quadrants are incorporated into three phases. These three phases are:

**Phase 1**: 1S, conference room, 2N, telecom room, and breakroom.

**Phase 2**: 1N (cabling to WAPS, weekend work) (starts midway through Phase 1)

**Phase 3**: 2S (cabling to each workstation) (starts after 2S tenants move into completed 2N area)

1.01 REQUIREMENTS INCLUDE:

A. This contract package shall include and conform to the work as defined in the Contract Documents and as further defined below. Work shall be done per plans and specifications as prepared by HY Architects, this Scope of Work, the Contract, General Conditions, Supplementary Conditions, General Requirements, the Preliminary Project Schedule and other related Documents.

1. This bid package includes all SCOPe as shown on the contract documents and as further defined in this Scope of Work.

2. Bidders shall visit and inspect the site of the proposed work and shall become familiar with all the conditions and schedule requirements surrounding the construction of the proposed project.

3. The contractor shall furnish all labor, materials, tools, equipment, machinery, equipment rental, hoisting of materials, transportation, supervision, bonds, taxes, insurance, engineering and other items necessary to perform all work.

4. Perform a pull plan at the preconstruction meeting with the university representative, subcontractors, architect, consultants, and PO&M.

5. Bidders are responsible for thoroughly reviewing the existing conditions of the project and shall be responsible for being familiar with the existing, in place, structures, utilities, referenced adjacent utilities whether touched by this scope of work or not, and the general surroundings of the site as they relate to this Scope of Work.

6. Please provide the following alternates:

   **Alternate #1.** Alternate to demolish existing window blinds and provide new manual roller shades.

   **Alternate #2.** Alternate for new acoustical panels in conference room 1116 and 1114.

   **Alternate #3.** Alternate to delete wall and door at shared office 1002. This is the east wall of room 1002, and door 101, between the elevator and room 1106.
Alternate #4. Alternate to eliminate furnishing new lighting. If accepted, Contractor to provide University with needed delivery date of lighting and provide offload and inventory of lighting provided by others.

Alternate #5. Alternate to eliminate the furnishing and installing of new lighting. If accepted, Contractor to provide rough-in and wire only. All lighting work will be performed by PO&M and lighting work shall be coordinated with the University Representative and PO&M on the Project. Demolition of existing lighting and wiring as shown on plans is by contractor.

Alternate #6. Alternate to install new lighting to replace all existing lighting within the Medical Records Building but shown outside of the scope of work areas. Lighting will be OFCI. If accepted, Contractor to provide University with needed delivery date of lighting, and provide offload and inventory of lighting provided by others.

B. This contract includes any out-of-sequence and come-back work ordered by the University's Representative or is required to meet any activity within the Preliminary Project Schedule.

PART 2 – SPECIFIC REQUIREMENTS

2.01 SPECIFIC REQUIREMENTS INCLUDE:

A. The following Specific Requirements are intended to clarify and/or amplify the requirements of this contract and do not necessarily describe the full extent of the contract work. This contract includes all work indicated or reasonably inferred by the Contract Documents and as required to provide complete, functional and operational systems and subsystems. Specific references to drawings, details, specifications, etc., are included to illustrate the type of work and highlight certain portions of the work only and do not address all of the work involved. Bidders must review all of the Bid Documents and visit the site to determine the full extent of the Work.

B. This contract package completely includes, but not limited to, all work contained in the following specification sections and exhibits:

General Conditions
Supplementary Conditions

01110 Summary of the Work
01220 Allowance
01230 Alternates
01250 Clarification/Information Procedures
01255 Contract Modification Procedures
01290 Measurement and Payment
01310 Coordination
01320 Contract Schedules
01330 Shop Drawings, Product Data and Samples
01340 Contractor(s) Emergency Procedures
01350 Special Procedures
01410 Regulatory Requirements
01420 References
01450 Quality Control
01452 Seismic Control – Non-OSHPD
01455 Inspection of Work
01510 Temporary Utilities
01520 Construction Facilities
01550 Vehicular Access and Parking
01560 Temporary Barriers, Enclosures and Controls
01610 Project Requirements
01730 Cutting and Patching
01740 Cleaning
01760 Protecting Installed Construction
01770 Closeout Procedures
01780 Closeout Submittals
01810 Plumbing/HVAC Testing Procedures
02070 Selective Demolition
03300 Cast-In-Place Concrete
05410 Metal Stud System
06200 Finish Carpentry
06410 Custom Casework
07110 Sheet Membrane Waterproofing
07210 Building Insulation
07264 Water Vapor Emission Control Barrier
07310 Roof Coverings
07600 Flashing and Sheet Metal
07920 Caulking and Sealants
08100 Hollow Metal Doors and Frames
08210 Wood Doors
08310 Access Doors
08710 Finish Hardware
09210 Gypsum Plaster
09250 Gypsum Board
09310 Ceramic Tile
09510 Acoustical Tile Ceilings
09651 Resilient Tile Flooring
09653 Resilient Flooring Accessories
09861 Carpet Tile
09900 Painting
09950 Wall Coverings
10155 Toilet Compartments
10265 Impact Resistant Wall Protection
10425 Interior Signage and Exterior Specialty Signs
10800 Room Accessories
10801 Toilet and Bath Accessories
12494 Window Shades
15010 Basic Mechanical Requirements
15050 Basic Mechanical Materials and Methods
15060 Pipes and Pipe Fittings
15100 Valves and Piping Specialties
15250 Mechanical Insulation
15300 Fire Protection
15400 Plumbing Piping Systems
15440 Plumbing Fixtures and Trim
15450 Plumbing Equipment
15500 Hydronic Systems and Equipment
15890 Ductwork
15910 Duct Accessories
15990 Plumbing/HVAC Final Testing, Adjusting, and Balancing
16010 Electrical General Requirements
16070 Remodeling Electrical Installations
16110 Raceways
16112 Surface Metal Raceway (MOA)
16113 Cable Tray
16114 Telecommunication Wire Cable Tray
16120 Wires and Cables
16131 Pull, Splice, and Junction Boxes
16132 Floor Boxes
16135 Electrical Boxes and Fittings
16140 Wiring Devices
16160 Cabinets
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16190 Equipment Supports
16195 Electrical Identification
16450 Grounding
16470 Panelboards
16510 Lighting Fixtures
16700 Common Work Results for Communications
16705 Grounding and Bonding for Communications Systems
16710 Hangers and Supports for Communications Systems
16712 Conduits and Backboxes for Communications Systems
16740 Identification for Communications Systems
16760 Communications Cabinets, Racks, Frames, and Enclosures
16765 Communications Termination Blocks and Patch Panels
16770 Communications Cable Management
16790 Communications Horizontal Cabling
16960 Electrical Equipment Acceptance Testing

**Exhibits:** These drawings have been provided to assist the contractor in the development of its bid. The intent of these drawings is to show the general nature of the existing conditions. These drawings may not necessarily accurately depict the existing conditions. Verify the existing conditions prior to the start of any work of contractor. These documents include:

*Exhibit 1 – Instructions to Bidders*
*Exhibit 2 – Coordination Reference Drawings*
*Exhibit 3 – Path of Travel Campus Site Map*
*Exhibit 4 – Site Logistics*
*Exhibit 5 – Hazardous Materials Reports*

This report has been generated by Entek Consulting Group labeled “Medical Records Building Refurbishment Building” dated 8-8-2019.

*Exhibit 5A – Hazardous Materials Report*

This report has been generated by Entek Consulting Group labeled “Supplemental Asbestos Bulk Sample Results, Medical Records Building Refurbishment Building, 4010 Stockton Boulevard, Sacramento, CA 95817” dated 9-11-2019.

*Exhibit 5B – Hazardous Materials Report*

This report has been generated by Entek Consulting Group labeled “Supplemental Asbestos Bulk Sample Results, Medical Records Building Refurbishment Building” dated 9-11-2019.

Exhibit 6 – Signage Reference Plan

Exhibit 7 - Reference Schedule:

The reference schedule is mandatory unless a contractor’s proposed schedule is advantageous to the owner. A pull plan will be performed at the preconstruction meeting to help validate the schedule. The contractor will be responsible for organizing and leading the pull plan meeting with his subcontractors, the architect, and any other party deemed necessary. The intent of this schedule is to show the general nature of timeframe and phasing required in the project. It may be required work to be performed in several areas of the project simultaneously in order to achieve the overall project scheduled completion. As each area becomes available, the contractor will be required to work in those respective areas with additional crews if deemed necessary by the University’s Representative to meet any activity within the contract schedule.

C. This contract includes the General Conditions, Supplementary Conditions, Division 1 General Requirements, drawings, any addenda or changes to the construction documents, all specification sections required for the performance of this Scope of Work.

D. This bid package shall include but not be limited to the following. The following consists of additions to the Contract Documents, highlighted items, and specific items required which may or may not be shown or called out on the drawings or specifications. It is not the complete definition of work.

Note: “provide” means to furnish and install

1. Provide all items in the drawings and specifications.
2. Include an Allowance of $7,500 for unforeseen conditions including but not limited to water intrusion, mold, cleaning of existing surfaces including, but not limited to, interior windows, frames, exterior windows, and existing carpet. University to be notified of start of this scope work, and work to be tracked on extra work tags, to be submitted to University Representative on a daily basis.
3. Include an Allowance of $7,500 for wall touch-up after furnishings are installed. University to be notified of start of this scope work, and work to be tracked on extra work tags, to be submitted to University Representative on a daily basis.
4. Provide a project laydown area with fencing and SWPPP. Fencing surrounding to be minimum 6’-0” tall and screened and installed to prevent fencing from falling over. Provide proper SWPPP (Stormwater Pollution Prevention Plan) measures around the laydown area and site. Laydown area to be constructed to prevent track out of mud, debris, etc from area. Coordinate with PO&M for removal and/or relocation of irrigation system, in order to keep adjacent area unaffected. Upon completion of the project, return area to the previous condition (replace all landscape that was removed or damaged, and return all irrigation back to its original state).
5. Access to the Medical Records project site is per EXHIBIT-3 Path of Travel Campus Site Map. Vehicles larger than a 1-ton pickup are not permitted off the roadway onto pedestrian pathways. Large deliveries are permitted on Colonial Way, driver must always stay with the vehicle, and a minimum 48hr notice of a delivery must be given. This is in addition to Specification 01550.
6. Vehicles that access the laydown and project area on the pedestrian pathway must always be accompanied by a flag person. Pedestrian pathway must not be blocked. Pedestrian pathway must be kept in a clear, and ADA accessible state, any damage must be fixed immediately. This is in addition to Specification 01550.
7. Material access to the building shall be through the existing front doors. Any damage to the doors shall be fixed and/or replaced prior to occupancy of the 1st Floor south area. Existing elevator is not to be used by construction personnel for any reason. Material access to the 2nd floor is to be though noted window on the logistic plan. Contractor to provide for removal and storage of existing glazing, protection of existing surround, temp weather enclosure, and replacement of glazing at the completion of work. Any damage to be repaired as part of the project.

8. Provide temporary construction barriers between public areas and construction areas to prevent dust from entering public use areas. Construction barriers to be built to minimize noise from construction activities. Doors (minimum 42” wide) to be installed in construction barriers to maintain egress pathways to egress doors within construction areas. Reference specification 01560 for additional information. Submit plan showing location of barriers for review and approval by University Fire Authority per specification section 01350.

9. Elevator not to be used by construction personnel. Access to the elevator must always be maintained during the project for use by the existing building occupants and visitors.

10. Existing building restroom facilities are not permitted for construction personnel.

11. Provide debris removal. Contractor to provide service to remove construction debris from the site. (for reference, UC Davis Medical Center uses First Republic for its current service)

12. Remove sliding glass door in 1st floor North (door located in between vestibule and open office space) and provide patching of flooring, drywall, and paint to match existing to construct new cased opening.

13. Provide temporary signage directing existing tenants to the building safely.

14. Provide temporary no-access signage to courtyard area on both interior and exterior sides of the door.

15. Provide proper temporary signage at all doors that lead to construction areas.

16. Provide signage for emergency exit doors.

17. Install new signage throughout the building including but not limited to offices, IT rooms, electrical rooms, storage rooms, conference rooms, breakrooms, no-exit signs, emergency signs, and exit signs. Project signage is OFCI. Reference Exhibit 6 – Signage Reference Plan.

18. Contractor to provide a clean and clear route for public access to elevator at all times. Contractor is not permitted to use elevator.

19. Provide, maintain, and install, per SWPPP requirements, temporary construction restroom facilities. Existing building restroom facilities are not to be used for construction personnel.

20. Change out hardware and rekey locks per Specification 08710 at offices 1007, 1106, 1109, 1118, 1120, Shared office 1002, 1202, 1204, 12008, 1210, 2202, 2204, 2206, 2208, 2210, 2212, 2214, 2216, 2218, 2220, 2222, 2224, 2225, 2226, 2227, 2228, 2229, and 2234. Contractor to perform final install of cylinders (of new and replacement of existing) after University keying of cylinders (reference Specification 08710).

21. Provide for safe access of University PO&M personnel to replace lighting above the interior stair (Stair #2).

22. Provide all safety protocols and Interim Life Safety Measures (ILSM) as described in 01350 Special Procedures.

23. Protect all existing flooring and surfaces.

24. Protect walk off mat from construction damage.

25. Contractor shall protect all existing ceiling grid and is responsible for repairing any damage to ceiling grid noted to stay as-is.

26. Provide and maintain safe access per Cal OSHA requirement for roof work.

27. All construction activities to be contained in construction areas, including but not limited to individuals, tools, materials, sound, dust, and airflow.

28. Provide description of work to university representative to attain an ICRA permit and attend the ICRA permitting meeting.

29. Provide a 2 week notice for a Request for Shutdown or Request for Support (RFS) or any other university or PO&M related request.

30. Provide all signage on construction barriers as shown in 01560 including but not limited to ICRA forms, building permit, and Caution forms.

31. Demolition of existing lighting and wiring noted in the drawings is by contractor.
32. Provide proper notice for requests for inspections as written in the Specification 01455.
33. Attend all weekly meetings and check-in with University Representative.
34. Provide a pull plan at the preconstruction meeting.
35. Submit all submittals before mobilization unless otherwise accepted by the University Representative.
36. Provide all submittals, RFI’s and other paperwork as written in the specifications.

Special Considerations to be adhered to by the contractor are as follows:

37. There may be other University construction projects in the area, which will require coordination to minimize conflicts.
38. The cutting of structural members will not be permitted without prior written approval from the University Representative.
39. Gasoline and/or diesel-powered welding, cutting or erection equipment are only permitted with exhaust scrubbers. 120v power will be available for hand tools only. Provide any Air Permits required by CARB or SMAQMD for the work of this contract.
40. Include replacement of any safety protection that you move for your operations.
41. Conform to all regulatory agencies and requirements applicable to this project which includes, but is not limited to, the FAA, OSHA, and CAL OSHA and CALTRANS and all other requirements of safety and hazardous material procedures throughout the execution of this contract. When hoisting materials, be aware that there is an active and operational helicopter pad on the adjacent campus. FAA and CALTRANS regulations regarding safety must be met and adhered to.
42. This contractor shall not encumber the project site as determined by the University’s Representative, with materials or equipment. Storage inside the building is limited and restricted. During the performance of the Work, the contractor shall keep the project site and surrounding area free from the accumulation of excess materials, waste materials and rubbish caused by this contractor. This contractor shall remove and/or relocate all excess materials, waste materials, rubbish, tools, equipment, machinery and surplus materials caused by or for this contract from the project site and surrounding areas when directed by the University’s Representative and at the completion of the Work. All trash/debris to be removed from project site each night before completion of shift. All debris buggies used inside the hospital to have manufactures lids.
43. Prior to commencement of any work involving interruptions of existing systems such as corridors, or penetrations through rated partitions, contractor shall develop detailed work plans per UCDMC policies and procedures indicating the sequence of operations and activities for these operations. The work plans shall indicate time frames and dates for work required before, during and after interruption of existing services. The work plans shall indicate the total number of hours anticipated for interruptions. The work plan shall include detailed drawings of systems indicating temporary barriers and enclosures to allow the operating systems to remain active or shutdown for the minimal amount of time. Work plans shall be presented to the University’s Representative in accordance with the requirements of Division 1 prior to beginning work.
44. Coordinate the delivery dates of materials with the University’s Representative, so that they can be reflected in the contract schedule. Identify any major materials and equipment that will require special access considerations.
45. Weekly meetings will be held with the Architect, University Representative, Contractor, and any necessary subcontractors during the duration of the project.
46. Clean up debris to dumpster on a daily basis, or as directed by University's Representative. All packing and crating material must be removed and hauled off daily by the contractor. The contractor shall sweep and clean each day its work areas or as deemed necessary by the University’s Representative. Transport all debris associated with the contract package and place debris inside the appropriate dumpster.

47. During all welding, brazing, soldering, grinding and cutting operations provide fire extinguishers, fire watch (includes an additional half hour upon completion of hot work performed), ventilation and other measures required to maintain a safe site as required for the Scope of Work. Provide supplemental mechanical ventilation (smoke hogs, and or negative air machines, fans etc.) to safely remove all smoke, fumes and odors as required to complete this work.

48. Obtain Hazardous Conditions Permit (hot work) for the work described as required by the University Fire Department / Fire Marshal / Fire Life Safety Officer. Obtain permits prior to any welding, cutting or brazing per the requirements of Division 1.

49. Protect existing facilities and the work of other contractors from damage by work under this contract. The contractor is responsible for all cost and time impacts resulting from damage of installed work or stored materials.

50. Schedule, coordinate, and perform all field-testing as required for inspections.

51. Provide traffic control, barricades and flagmen as required to complete the work of this contract.

52. Allow for minor refinement of construction details and dimensions during the submittal review process. No change orders will be allowed for minor refinements such as additional detailing, fabrication or installation of these minor modifications required to complete the work of this contract.

53. Protect all work defined in this contract until accepted by the University's Representative.

54. Fire Stopping: Contractor is responsible for fire stopping any penetrations that their work creates through rated assemblies (floor, wall, and ceiling) regardless of when the penetrating member was installed. Also each trade will be responsible for maintaining penetrations until approved by the inspector. All fire stopping penetrations must comply with approved UL – including bracing assembly.

55. Provide drawings and submittals as required.

56. Attend and participate in regular and special coordination and progress meetings as required and scheduled by the University's Representative.

57. Provide task lighting as required to complete the work of this contract.

58. Warranties shall commence upon project "final completion".

59. Provide shop drawings, manufacturer’s data and samples.

60. The contractor shall provide all testing and certification as defined in the contract documents.

61. Prior to performing any concrete demolition, including coring, chipping and saw-cutting, the contractor shall scan the concrete to verify what is installed in the concrete. Should conduit, any reinforcing or any other system be detected, the contractor shall immediately notify the University’s Representative.

62. Internal combustion engines (gasoline, diesel, propane, etc,) are prohibited from being operated indoors.

63. Bidders shall provide any required fuel, oil and other consumables required for their equipment and store them in an OSHA/CalOSHA compliant manner.

64. Bidders to include all costs for drinking water and ice required by their own forces.

65. Bidders shall include all required material hoisting methods for their scope of work.

66. Bidders shall include all costs in their bid for installation, maintenance and removal of secondary containment of fuel drums or other similar items as required by all applicable codes. Comply with project SWPPP requirements.
67. Daily cleanup is essential to a safe job site. It will be the responsibility of the contractor to keep the project clear and clean on a daily basis and to remove debris from the site in a timely fashion. Site access is limited there is no space available for the placement of debris boxes. Costs for clean-up, hoisting, scaffolding, and protection of installed work and adjacent surfaces are to be included in the base bid.

68. The bidders shall include all costs to secure their materials or equipment at no additional cost to the University.

69. Refer to Site Logistics Plan Exhibit for detailed information on parking and access.

END OF SECTION
SECTION 01110
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. Concurrent Work Under Separate Contracts
F. Site Condition Survey and Protection of Existing Improvements
G. Contractor Use of Site and Premises
H. University Beneficial Occupancy (if applicable)
I. Project Phasing (if applicable)

1.02 DESCRIPTION OF THE WORK

A. Project is titled: 9559620 - MEDICAL RECORDS BUILDING REFURBISHMENT
B. UCDMC Project No.: 9559620
C. Project is located at 2221 Stockton Blvd, Sacramento, CA 95817 University of California, Davis Medical Center, Sacramento, California, as shown on the vicinity map.
D. Project is:

The Medical Records Refurbishment project is located within the Medical Records building. This building is an operating office-staff building where employees are working. This is a non-OSHPD job. Overview of the job scope is to renovate the vacant interior sections of the building and upgrade the data cabling in the entire building. The main scope of work includes, but is not limited to, soft demolition, interior framing, finish carpentry, doors and frames, flooring, finishes, ceiling tile replacement, signage, lighting, electrical, low voltage cabling, and mechanical.

The work of this contract is divided into multiple phases. See Exhibit 2 – Coordination Reference Drawings and Exhibit 7 – Reference schedule, that includes, but not limited to, the phasing and work required for this project. There are 4 main quadrants of the project. The 4 quadrants include 1st floor north (1N), first floor south (1S), 2nd floor north (2N), and 2nd floor south (2S). Contractor shall assemble a site logistics plan that includes
necessary access to the building, laydown areas, and material delivery. Elevator to 2nd floor is off-limits to contractor.

E. Build-out as shown and specified in the contract documents, including new remodeled areas and phasing of existing tenants, shall be complete and ready for occupancy.

1.03 CONTRACTOR WARRANTS

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

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

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

1.04 CONTRACT DOCUMENT INTENT AND RELATIONSHIPS

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

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

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

D. Bidding and Contract requirements: Information for bidding, Conditions of the Contract and other Contract documents will be produced by University and may be included in the Contract Documents for convenience. Such documents are not Specifications. Specifications are found in Divisions 1 through 16 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 16 of the Contract.

1.05 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 right to back-charge Contractor for additional work.

1.06 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 AM to 5:00 PM, 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 01510 - 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) days notice of all utility outages and shutdowns.

1.07 PROJECT PHASING

A. The WORK OF THIS contract is divided into multiple phases. See provided McCarthy schedule, for informational purposes only, included but not limited to the phasing and work required for this project. There are 4 main quadrants of the project. The 4 quadrants include 1st floor north (1N), first floor south (1S), 2nd floor north (2N), and 2nd floor south (2S). Phases include:

Work of these quadrants are incorporated into three phases. These three phases are:

- **Phase 1**: 1S, conference room, 2N, telecom room, and breakroom.
- **Phase 2**: 1N (cabling to WAPS, weekend work) (starts midway through Phase 1)
- **Phase 3**: 2S (cabling to each workstation) (starts after 2S tenants move into completed 2N area)

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not applicable to this Section

END OF SECTION 01110
PART 1 - GENERAL

1.01 GENERAL

A. The Contract Lump Sum Base Bid as entered in Article 4.0 of the Bid Form shall include the amounts for all Allowances required in this section and elsewhere in the Contract Documents. All Allowances shall be provided by the Contractor for the amounts indicated.

B. The following shall apply to the Allowances, unless otherwise indicated in the Contract Documents:

1. Allowance amounts shall be for the full amount of compensation, both direct and indirect, and contain all overhead costs including but not limited to supervision, support, taxes, bonds, insurance, and profit.

2. Allowances shall be for complete compensation to the Contractor for all materials and equipment delivered at the Project site, including all overhead, taxes, insurance, shipping, and handling.

3. Allowances shall be for complete compensation to the Contractor for all labor amounts and shall include all overhead, supervision, support, tools and equipment to perform the work directed by the University’s Representative.

4. Allowances for tradesmen in labor amounts will be utilized and directed by the University’s Representative. These amounts are for work not included in the scope of the contract documents and are solely for the use and direction by the University’s Representative.

5. Upon project closeout, adjustments for any remaining quantities of the amounts included in the Allowances will be deleted from the contract sum on a per unit basis.

1.02 DESCRIPTION OF ALLOWANCES

1. Include an Allowance of $7,500 for unforeseen conditions including but not limited to water intrusion, mold, cleaning of existing surfaces including, but not limited to, interior windows, frames, exterior windows, and existing carpet. University to be notified of start of this scope work, and work to be tracked on extra work tags, to be submitted to University Representative on a daily basis.

2. Include an Allowance of $7,500 for wall touch-up after furnishings are installed. University to be notified of start of this scope work, and work to be tracked on extra work tags, to be submitted to University Representative on a daily basis.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION 01220
PART I - GENERAL

1.01 GENERAL

A. This Section identifies each Alternate and describes basic changes to the Work only when that Alternative is made a part of the Work by specific provision in the Agreement.

B. Lump Sum Base Bid and Alternates shall include costs of all supporting elements required, so that combination of Lump Sum Base Bid and any Alternates shall be complete. Scope of Work for all Alternates shall be in accordance with applicable Drawings and Specifications.

C. Except as otherwise specifically provided by University, Work described in Alternates shall be completed with no increase in Contract Time.

D. This Section includes only non-technical descriptions of the Alternates. Refer to Sections of Division 2 - 16 of the Specifications for technical descriptions of the Alternates.

E. Coordinate related Work and modify surrounding Work as required to properly and completely integrate Alternates into the Work.

1.02 DESCRIPTION OF ALTERNATES

A. Alternate 1: Alternate to demolish existing window blinds and provide new manual roller shades.

B. Alternate 2: Alternate for new acoustical panels in conference room 1116 and 1114.

C. Alternate 3: Alternate to delete wall and door at shared office 1002. This is the east wall of room 1002, and door 101, between the elevator and room 1106.

D. Alternate 4: Alternate to eliminate furnishing new lighting. If accepted, Contractor to provide University with needed delivery date of lighting and provide offload and inventory of lighting provided by others.

E. Alternate 5: Alternate to eliminate the furnishing and installing of new lighting. If accepted, Contractor to provide rough-in and wire only. All lighting work will be performed by PO&M and lighting work shall be coordinated with the University Representative and PO&M on the Project. Demolition of existing lighting and wiring as shown on plans is by contractor.

F. Alternate 6: Alternate to install new lighting to replace all existing lighting within the Medical Records Building but shown outside of the scope of work areas. Lighting will be
OFCl. If accepted, Contractor to provide University with needed delivery date of lighting, and provide offload and inventory of lighting provided by others.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not applicable to this Section

END OF SECTION 01230
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


B. Section 01610 – 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.

1.04 RFI PROCEDURES

A. RFI Format, Numbering and Subject:

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

2. RFI Numbering: Number RFI’s 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. Faxed RFI requests will be accepted. University's Representative's fax number is 916-734-7751. Notification time begins from date stamp of University's fax machine. Faxed RFI requests received after normal business hours and/or received on non-normal workdays, as defined in Specification Section 01310 – COORDINATION, Item 1.07.F.4.A will begin notification time starting at 7:00 AM the following business day.

B. Failure to provide proper information: RFI's 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) days.
Actual time may be lengthened for complex issues, or shortened for expedited situations, as mutually agreed in writing.

2. After submission of an RFI by Contractor and prior to receipt of the RFI response from University, the Contractor proceeds with effected Work at own risk. Any portion of the Work not constructed in accordance with University interpretation, clarification, instruction or decision is subject to removal and replacement at Contractor expense.

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

END OF SECTION 01250
REQUEST FOR INFORMATION

A/C #: ________ Project Title: ________
RFI #: ________ Date: ________ OSHPD #: ________

University of California, Davis, Medical Center
Facilities Design & Construction
4800 2nd Avenue, Suite 3010, Sacramento, CA 95817
Attn.: Derek Beyer
C: 916-712-3024
Email: dkbeyer@ucdavis.edu

SUBJECT: ____________________________________________

SPEC SECTION/DRAWING #: PARA: DETAIL: RM # GRID #

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<tr>
<th>TRANSMITTAL RECORD</th>
<th>Requestor to FD&amp;C</th>
<th>FD&amp;C to A/E</th>
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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 UCDMC FD&C PROJECT MANAGER IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

COPIES: ☐ UCDMC ☐ CONSULTANTS ☐ ____________ ☐ ____________ ☐ ____________ ☐ FILE
PART I - GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED DOCUMENT SECTIONS

B. Section 01250 – CLARIFICATION/INFORMATION PROCEDURES
C. Section 01290 – MEASUREMENT AND PAYMENT: Applications for Payment.
D. Section 01610 – PRODUCT REQUIREMENTS: Product Options, substitutions, omissions and improper descriptions.
E. Section 01770 – CLOSEOUT PROCEDURES: Project record documents.
1.03 CHANGE ORDER ADMINISTRATIVE REQUIREMENTS

A. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ of subcontractors of changes in the work.

B. Forms found in the Exhibits of the Contract:

1. COST PROPOSAL Form
2. SUPPORTING DOCUMENTATION FOR THE COST PROPOSAL SUMMARY Form
3. CHANGE ORDER Form
4. REPORT OF SUBCONTRACTOR INFORMATION Form

1.04 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

A. Documentation of Changes in Contract Sum and Contract Time: Provide full information required for evaluation of proposal of proposed changes and to substantiate costs of changes in the Work.

1. Maintain detailed records of Work completed on time and material basis.
2. Document each quotation for a change in Contract Sum and Contract Time with sufficient data to allow evaluation of the quotation.

B. Additional Data: Upon request, provide additional data to support computations.

1. Quantities of products, labor and equipment.
2. Taxes, insurance and bonds.
3. Overhead and profit.
4. Justification for change in Contract Time, if claimed.
5. Credit for deletions from Contract, similarly documented.

1.05 CHANGE PROCEDURES

A. University's Supplemental Instructions: Minor changes in the Work, not involving adjustments to the Contract Sum or Contract time, as authorized by the General Conditions of the Contract, may be presented using Supplemental Instructions or correspondence containing similar information.

B. University Initiated Changes: A "Request for Proposal" may be issued by University's Representative, which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications.
1. The Request for Proposal may include an estimate of additions or deductions in the Contract Sum or Contract Time for executing the change and may include stipulations regarding overtime work and the period of time the requested response from the Contractor shall be considered valid.

2. Contractor shall prepare and submit a response to the Request for Proposal within fourteen (14) days.

C. Contractor initiated Changes: Contractor may propose a change by submitting a request for change to University's Representative, describing proposed change and its full effect on the Work.

1. Include statement describing reason for change, and full description of effects on Contract Sum, Contract Time, related Work and work being performed under separate contracts.

2. Requests for substitutions shall be included under this category, with procedures as specified in Section 01610 – PRODUCT REQUIREMENTS.

1.06 FIELD ORDER

A. Field Order: University's Representative may issue a "Field Order", signed by University's Representative, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The document will describe changes in the Work, and will designate the method of determining what, if any, change is due in the Contract Sum or the Contract Time.

2. Promptly execute the change in the Work.

B. Cost and Time Resolution: Costs and time adjustments for changes in the Work shall be per provisions of the General Conditions of the Contract, unless otherwise agreed to prior to issuance.

1.07 CHANGE ORDERS

A. Stipulated Sum Change Orders: Contractor's response to Request for Proposal or Field Order will be considered and a mutually acceptable adjustment in Contract Sum and
Contract Time will be determined. Change Order for this stipulated amount will be prepared by University's Representative for execution by University and Contractor.

B. Unit Price Change Order: Change Order will be prepared by University's Representative for execution by University and Contractor, based on mutually acceptable quantities and pre-determined unit prices.

1. For unit cost or quantities not pre-determined, the Work shall be accomplished under a Stipulated Sum Change Order, if there is no dispute over the estimated or stipulated maximum cost and time for the change.

2. If the amounts are not defined or are disputed, a Field Order will be prepared and issued by University's Representative.

C. Time and Material Change Orders: As directed for changes for where amounts are not defined or are disputed, Contractor shall execute the Work, keeping accurate records of time, both labor and calendar days, and cost of materials.

1. Contractor shall prepare and submit an itemized account and supporting data after completion of the change, within the time limits indicated in the Conditions of the Contract.

2. University's Representative will determine the change allowable in Contract Sum and Contract Time, as provided elsewhere in the Contract Documents, and make recommendation to University for acceptance of Change Order.

3. Contractor shall provide full information as required and requested for evaluation of proposed changes, and to substantiate costs for changes in the Work.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION

3.01 EXECUTION OF CHANGE ORDERS

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

3.02 RECONCILIATION OF CHANGE ORDERS

A. Schedule of Values: Promptly revise the Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjustment to the Contract Sum.

B. Schedules: Upon completion of the Change Order, promptly revise progress schedules to reflect changes in Contract Time, revising sub-schedules to adjust time for other items of Work as may be affected by the change. Submit revised schedules with next Application for Payment.

END OF SECTION 01255
SECTION 01290
MEASUREMENT AND PAYMENT

PART I - GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and presentation of Application for Payment.

1.02 RELATED DOCUMENTS AND SECTIONS

A. GENERAL CONDITIONS of the Contract: Progress Payments and Final Payment.

B. Section 01320 – CONTRACT SCHEDULES

C. Section 01770 – CLOSEOUT PROCEDURES

1.03 PAYMENT APPLICATION FORM

A. Payment Application Form: Prepare Applications for Payment using Exhibit 4 provided in the Contract or, if otherwise directed, prepare Applications for Payment on AIA Document G702 – Application and Certification for Payment; include continuation sheets as necessary, using AIA Document G703 – Continuation Sheet.

1.04 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 typewritten on the required forms. Media-driven forms are acceptable.

2. Execute certification by wet ink signature of authorized officer of the Contractor.

3. Use data from the approved Schedule of Values. Provide dollar value in each column of application for each line item and portion of Work performed and for products stored, if permitted.

   a. List value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for progress Payments. Round off values to nearest dollar. Listed items of work shall be identified by Specification Section number.

   b. List products and operations of each major subcontract as separate line item.

   c. Include Work Allowances (if any) within line item of Work.

   d. Coordinate listings with Progress Schedule.

   e. Component listings shall each include a directly proportional amount of Contractor's overhead and profit.
f. For items on which payments will be requested for stored products. List sub-values for cost of stored products with taxes paid.

g. Submit a sub-schedule for each separate Phase of Work specified in Section 01110 – SUMMARY OF THE WORK. Include scheduling of sequences for Phase of the Work as indicated in the Contract Documents.

h. 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.

B. Final Payment: Prepare Application for Final Payment as specified in Section 01770 – CLOSEOUT PROCEDURES.

1.05 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) copy of each Application for Payment with one (1) original wet ink signature. 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 01320 – CONTRACT SCHEDULES.

3. Submit one (1) copy of the Schedule of Values in accordance with the General Conditions of the Contract. Form and content shall be acceptable to University. Transmit under transmittal letter. Identify Project by A/C # and name.

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.

b. For each major subcontract, list products and operations of that subcontract as separate line items.

c. Coordinate listings with Progress schedule.

d. Component listings shall each include a directly proportional amount of Contractor's overhead and profit.

e. For items on which payments will be requested for stored products, list sub-values for cost of stored products with taxes paid.

f. Submit a sub-schedule for each separate Phase of Work specified in Section 01110. Include scheduling of sequences within each phase indicated on the drawings.
g. The Sum of values listed shall equal total Contract Sum.

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

i. Provide one (1) copy 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 transmittal letter. Contractor shall identify all payment application documents by University's Project Name and University's Project Number.

1.06 SUBSTANTIATING DATA

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

B. Provide one (1) copy of data with cover letter for each copy of submittal. Show Application number and date and line item by number and description.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01290
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 01110 – SUMMARY OF THE WORK: Description of Contract Documents.
B. Section 01320 – CONTRACT SCHEDULES
C. Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
D. Section 01350 – SPECIAL PROCEDURES: Interim Life Safety Measures (ILSM).
E. Section 01450 – QUALITY CONTROL
F. Section 01455 – INSPECTION OF WORK
G. Section 01510 – TEMPORARY UTILITIES
H. Section 01520 – CONSTRUCTION FACILITIES
I. Section 01550 – VEHICULAR ACCESS AND PARKING: Traffic Regulation.
J. Section 01560 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS
K. Section 01561 – AIRBORNE CONTAMINANTS CONTROL
L. Section 01610 – PRODUCT REQUIREMENTS
M. Section 01730 – CUTTING AND PATCHING
N. Section 01770 – CLOSEOUT PROCEDURES: Coordination of completion reviews, inspections and submission of documents.
O. Section 01780 – CLOSEOUT SUBMITTALS: Record Drawings.
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) 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 01310 – COORDINATION.

   b. Subcontractors List: Distribute and discuss list of subcontractors and suppliers.

   c. Construction Schedule: Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work, including coordination of University furnished/Contractor installed (UFCI) 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 and oral communications.

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

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

   i. Submittals Administration: Review administrative procedures for shop drawings, project data and sample submittals and review of preliminary submittals schedule.

   j. Project Record Drawings: Review requirements and procedures for project record drawings and specifications.

   k. Construction Facilities and Temporary Utilities: Designate storage and staging areas, construction office areas; review temporary utility provisions; review University requirements for use of premises.

   l. Materials and Equipment: Review substitution requirements; review schedule for major equipment purchases and deliveries; review materials and equipment to be provided by University (UFCI products).
m. Site Access by University's Representative and University's Consultants: Review requirements and administrative procedures Contractor may institute for identification and reporting purposes.

n. Testing and Inspection: Review tests and inspections by independent testing and inspection agencies, manufacturers, and governing authorities having jurisdiction.

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

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.

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 copies within four (4) days 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) Request for Information
5) Safety Issues
6) Scheduling Status/2 Week Look Ahead
7) Inspection Requests
8) Utility Shutdowns and Dig Notifications
9) Instructional Bulletins and Field Orders
10) Change Orders/Cost Proposals
11) Payment Applications and As-Built Drawings
12) Miscellaneous Business

13) 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 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, Section 01770 – CLOSEOUT PROCEDURES and Section 01780 – 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 01330 – 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 01770 – CLOSEOUT PROCEDURES.

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

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

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

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

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

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

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

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

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

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

1.07 UNIVERSITY CRITERIA

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

B. Contractor shall provide large scale casework and equipment drawings for casework and equipment service rough-in locations (dimensioned from building features), service characteristics, and locations of studs or blocking where such locations are critical to mounting or otherwise installing equipment and casework. Furnish sizes and spacing required for mechanical and electrical cutouts, and a complete brochure of fittings, sinks, outlets, or other information to provide a complete assemblage of the items and accessories being furnished.
C. Interruption of Services: Construction Work shall accommodate University’s use of surrounding and adjacent premises during the construction period and shall provide continuous public access and use of surrounding and adjacent facilities. Contractor shall not deny access to public use facilities until an alternate means of public use has been provided. An interruption of service is defined as any event which in any way interrupts, disrupts or otherwise discontinues, even momentarily, the services provided by University to its patients and staff. Adequate notice, as described below, shall be given to University when any interruption of services or interference with the use of existing buildings and roads are anticipated. Any interruption of service will be made only by University upon such notice. Interruptions to University services will not be made without prior notification and approval by University. Contractor shall never interrupt any University service without direct University participation.

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

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

3. 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.

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

5. Record documents are required for dig activities. Contractor shall provide as-built drawings.

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

E. The University does not normally charge for its shutdown support services. However, if poor planning and/or poor execution of a shutdown by the Contractor causes excessive time and effort for University personnel, the University reserves the right to backcharge 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 shutdown.
3. Service shutdowns shall require specific work plans to be submitted to and coordinated with University's Representative. Work Plan should reflect various work trades, activities or entities requiring active participation with University teams to coordinating hospital functions with construction activities.

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

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

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

4. Planned service shutdowns shall be accomplished during periods of minimum usage. Contractor shall plan work to restore service in minimum possible time, and shall cooperate with 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 AM and after 5:00 PM in the evening, weekend days, or legal holidays, or such periods of time which constitute split shifts or split working periods.

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

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

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

G. Detailed Work Plans: Contractor shall develop and submit for review and approval to University's Representative detailed work plans for specific work activities, both inside and outside the work area, associated with impact to, or interruption of services and operation, and dig activities. Work Plans shall 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: These drawings are for the Contractor's and University's use during construction and shall not be construed as replacing any shop drawings, "as-builts", or record drawings required elsewhere in the Contract Documents. University's review of these drawings is for design intent only and shall not relieve the Contractor of the responsibility for coordination of all work performed per the requirements of the Contract.

a. Contractor shall prepare and submit complete ¼" = 1' - 0" coordination drawings, including plans, sections, details as are appropriate indicating the area layout, complete with debris removal area and materials access points, and all mechanical and electrical equipment in all areas and within ceiling spaces for new and existing conditions, including bottom of all duct, plenum, pipe and conduit elevations. Drawings shall show all structural and architectural restraints and other obstructions that may affect the work. Electronic or photo reproduction of University's Architectural Drawings is not acceptable.

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

c. Submit completed and fully coordinated drawings together with six (6) prints together with Contractor's comments indicating possible areas of conflict for review to University's Representative prior to start of work.
d. Penetrations: Contractor shall prepare a sleeving layout (¼" scale) indicating size and locations of sleeves. Trades shall indicate to Contractor their requirements and locations. Provide copies to applicable trades and University's Representative.

e. Completion of work: All coordination drawings shall be submitted together with record (as built) drawings of all trades involved in accordance with Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01310
REQUEST FOR SHUTDOWN (RFS) INFO/IMPACT REPORT

PROJECT NAME:  
UCDMC RFS #:  

PROJECT #:  OSHPD #:  CONTRACTOR RFS #:  

TODAY’S DATE:  SHUTDOWN DATE:  SUSPEND DATE:  

TO: UC DAVIS HEALTH  
Facilities Design & Construction  
4800 2nd Avenue, Suite 3010  
Sacramento, CA 95817  
P: 916-712-3024  
Attention: Derek Beyer  

FROM:  

Request Date:  
Shutdown Target Date:  
Requested By:  
Requestor’s Phone #:  

Shutdown Work (Utility Specific):  

Scope (Brief Description of Work):  

Impact (Areas & Users):  

Additional Comments:  

# DIG NOTIFICATION FORM

**TO:** UC DAVIS HEALTH  
Facilities Design & Construction  
4800 2nd Avenue, Suite 3010  
Sacramento, CA 95817  
P: 916-712-3024  

**FROM:**  

Attention: Derek Beyer  

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## UNIVERSITY USE ONLY

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<td>1. Utilities verified by IOR?</td>
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SECTION 01320
CONTRACT SCHEDULES

PART I - GENERAL

1.01 SECTION INCLUDES

A. Construction Progress Schedules
B. Submittals Schedules
C. Review of Schedules and Submittals
D. Construction Progress Reports

1.02 RELATED DOCUMENTS AND SECTIONS

A. GENERAL CONDITIONS OF THE CONTRACT: Requirements to provide schedules.
B. Section 01110 – SUMMARY OF THE WORK: Subcontractor and materials suppliers list.
C. Section 01255 – CONTRACT MODIFICATION PROCEDURES: Supporting data.
D. Section 01290 – MEASUREMENT AND PAYMENT: Supporting data submittals.
E. Section 01310 – COORDINATION: Progress Meetings.
F. Section 1330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES: Shop drawings, product data and samples submittals.
G. Section 01450 – QUALITY CONTROL: Test and Inspections Reports.
H. Section 01770 – CLOSEOUT PROCEDURES: Occupancy/Acceptance/Final Payment Submittals.
I. Section 01780 – CLOSEOUT SUBMITTALS: Preparation of maintenance and operating data.

1.03 CONSTRUCTION PROGRESS SCHEDULES

Schedule Format:

Prepare the Contract Schedules as Bar Charts showing continuous flow from left to right with logic ties between activities. Specific calendar dates shall be clearly and legibly shown for the start and finish of each Work activity.
Using opaque reproductions on substantial paper, with sheet size a multiple of 8-½” x 11" and large enough to clearly read characters. Prepare the schedule in sufficient detail to demonstrate adequate planning for the Work, and so that it represents a practical plan to complete the Work within the Contract time. Clearly indicate complete sequence of construction by major activity, including phasing with dates for beginning and completion of each element of Work.

1. Identify the following milestone events on the Contract Schedules:

   a. Demolition
   b. Interiors build-out
   c. Plumbing rough-in
   d. HVAC rough-in
   e. Electrical rough-in
   f. Interior Finishes
   g. 1st floor south cabling
   h. 1st floor north cabling
   i. 2nd floor north cabling
   j. 2nd floor south cabling
   k. Punchlist
   l. Shutdowns
   m. Submittal Reviews

2. Identify all holidays and non-working days on the Schedules.

3. Identify all Work activities that constitute the project critical path including:

   a. Major Contractor-furnished equipment, materials, and building elements, and scheduled activities requiring submittals or University's prior acceptance. Show dates for submissions, reviews, and acceptance of each submittal. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, material, and building elements, and for scheduled activities designated by University Representative.

   b. System test dates.

   c. Scheduled overtime Work if required by Contract Documents.

   d. Dates Contractor to request: designated working spaces, storage areas, access, and other facilities to be provided by University Representative; responses from University on designated issues; University-furnished equipment; University-furnished utilities.

   e. Dates for connection and relocation of existing utilities; dates for connections to or penetrations of existing structures.

   f. Scheduled inspections as required by Code, or as otherwise specified.

4. Critical path activities are defined as Work activities which, if delayed or extended, will delay or extend the scheduled completion of one (1) or more of the milestones specified in this Section or in the scheduled completion of the Work, or both. All other Work activities are defined as non-critical path Work activities and are considered to have associated float.
5. Float is defined as the time a non-critical Work activity can be delayed or extended without delaying the scheduled completion of milestones specified in this Section or the scheduled completion of Work, or both. Neither contractor nor University shall have exclusive right to the use of float. The entity using the float of any non-critical activity shall document the effect on the updated Contract Schedule.

6. Delays of non-critical Work activity shall not be the basis for an extension of Contract Time until the delays consume the float associated with the specific non-critical work activity and cause the Work to become critical.

7. Presentation of each Work activity on the Contract Schedule shall include a brief description of the Work activity, the duration of the Work activity in calendar days, and a responsibility code identifying the subcontractor, trade or vendor performing the Work activity.

8. Contractor shall furnish cost estimates for each Work activity that cumulatively equals the total contract cost. Mobilization costs may be shown separately; other costs, such as profit, and bond shall be pro-rated throughout all activities.

B. Updating:

1. Review Contract Schedule with University's Representative once each week to incorporate all changes in the progress, sequences, and scope of Works activities into the Contract Schedule. Contractor shall submit at each weekly progress meeting to University Representative, a two (2) week "look ahead" schedule in a bar chart format which incorporates all changes in progress, services, and scope of work activities.

2. Prepare and submit to University's Representative updated Contract Schedule once each month. Contractor shall submit the updated Contract Schedule, in the form acceptable to University, at least seven (7) days prior to submitting the Application for Payment.

3. Updated Contract Schedule shall accurately represent the as-built condition of completed and in-progress Work activities as of the date of the updated Contract Schedule.

4. Updated Contract Schedule shall incorporate all changes mutually agreed upon by Contractor and University during preceding periodic reviews and all changes from Change Orders and Field Orders. University will determine acceptability of updated Contract Schedule within seven (7) days of its receipt.

5. The Accepted, updated Contract Schedule shall be the Contract Schedule of record for the period it is current and shall be the basis of payment during that period.
1.04 SUBMISSIONS

A. Preliminary Contract Schedule: Submit a preliminary schedule to University's Representative either:

1. Within ten (10) days of receipt of the Notice of Selection as apparent lowest responsible bidder or, with the Agreement under separate transmittal letter.

2. Adjustments to Preliminary Contract Schedule: Within seven (7) days of receipt of the Preliminary Contract Schedule, University's representative will notify Contractor in writing of acceptance of Schedule, or submit to Contractor request for adjustments to Contract Schedule.

B. Contract Schedule: Submit the finalized Contract Schedule, in the form and having general content acceptable to University's Representative within fifteen (15) days following Notice to Proceed and prior to submitting the first Application for Payment. Submit monthly revised Contract Schedules thereafter, accompanying the Applications for Payment. Within seven (7) days of receipt of the Contract Schedule, University's Representative will notify Contractor in writing of acceptance of the revised Contract Schedule.

1. Payment Processing Restriction: No Application for Payment will be processed nor any progress payment become due until Contract Schedule is accepted by University.

2. Posting: Post one (1) copy minimum, of most recent Contract Schedule in the construction job site office, readily available to University and University's Representative.

3. Archive: Preserve a minimum of two (2) copies of all superceded schedules, with a minimum of one (1) copy available at job site office for review by University or University's Representative.

C. Submittals Schedule: Prepare Submittals Schedule in a format at Contractor's option, either bar chart, PERT, or GANTT format, using opaque reproductions on substantial paper, with sheet size a multiple of 8-½" x 11" and large enough to clearly read characters. Coordinate format with Contract Schedule, specified above.

1. Submittals Schedule Content: List all items specified to be submitted, indicating submittal number, submittal type (product data, shop drawings, samples, quality control report, maintenance and operating data, and other descriptions); scheduled data submittal shall be made and date review be complete in order to maintain construction schedule.

2. Administration: Submit initial Submittals Schedule within fourteen (14) days of date of Agreement. After review, resubmit Submittals Schedule within ten (10) days and thereafter submit updated Submittals Schedules at each Construction Progress Meeting. Submit one (1) copy each to University and University's Consultant. Posting/Archiving shall be same as Contract Schedule.
1.05 REVIEW OF SCHEDULES AND SUBMITTALS

A. University Representative and University's Consultant's Review of Schedules: Schedule review by University's Representative and University's Consultants shall be only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents.

1. Review by University's Representative and University's Consultants shall not relieve the Contractor of compliance with requirements of the Contract Documents.

2. Changes in the Work shall not be authorized by submittals review actions.

3. No review action by University's Representative or University's Consultants, implicit or explicit, shall be interpreted to authorize changes in the Work. Changes shall only be authorized by separate written Change Order, in accordance with the General Conditions of the Contract.

B. University, University's Representative or University's consultants timely review of submittals and resubmittals.

1. University, University's Representative or University's Consultants shall have fourteen (14) calendar days to review all submittals and an additional fourteen (14) days of review of all resubmittals.

2. University, University's Representative or University's Consultant will prepare and keep log of review time of submittals.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01320
SECTION 01330
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 01110 – SUMMARY OF THE WORK: Subcontractor and materials suppliers list.

B. Section 01320 – CONTRACT SCHEDULES: Submission and review of schedules and submittals.

C. Section 01450 – QUALITY CONTROL: Test and Inspection Reports.

D. Section 01770 – CLOSEOUT PROCEDURES: Occupancy/Acceptance /Final Payment Submittals.

E. Section 01780 – 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 fourteen (14) calendar days from receipt to review all submittals fourteen (14) calendar days from receipt to review re-submittals.

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

3. Substitutions shall be submitted in accordance with Section 01610 – 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 Project name and A/C 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 and Non-reproducible Submittals: Submit the number of copies Contractor will need, plus one copy emailed to project manager in PDF format.

2. Initial/Re-submitted Shop Drawing Review(s): Submit one copy emailed to project manager in PDF format.

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 one copy emailed to project manager in PDF format. Contractor is responsible for providing all approved shop drawings for their use and their subcontractors and or suppliers use.

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. 09250 – 1  First submittal for Section 09250 – Gypsum Board
2. 09250 – 2  Second submittal for Section 09250 – Gypsum Board
3. 09250 – 2A Re-submittal of second submittal for Section 09250 – Gypsum Board
4. 09250 – 2B Second re-submittal of second submittal for Section 09250 – 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. Record Documents file maintained by Contractor.
3. Pertinent Separate Contractors.
4. Pertinent Subcontractors.
5. Pertinent Supplier or Manufacturer.

1.06 FIELD SAMPLES AND MOCK-UPS

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

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

2. The following samples are required for this project:
   a. Carpet
3. Fabricate each Sample and mock-up to be complete and fully furnished. Unless otherwise agreed, full-size complete samples will be returned and may be incorporated into field mock-ups and Work.

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

1.07 SUBMITTAL SCHEDULE

A. Submittals Schedule: refer to Section 01320 – 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 two (2) copies 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.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01330
PART I - GENERAL

1.01 The purpose of this specification is to outline, to the Contractor, the University’s policy and procedures for effective project site management of an emergency situation during the construction of projects at the UC Davis Medical Center.

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

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 (internal or external) has occurred and UCDMC operations will be immediately shifting to its emergency management mode. The terminology for a disaster occurring outside the Main Hospital facility is CODE GREEN – EXTERNAL, and for an incident occurring within, CODE GREEN – INTERNAL.

2.03 Code Green Alert – there will be times when UCDMC will have the opportunity to ready itself in advance of an emergency event (e.g., floods, work stoppage/strike, etc.). The Director (or designee) will place the hospital on a CODE GREEN – ALERT. During this alert status, departments will make immediate assessment of their on-site resources and prepare to augment those resources to ensure adequate levels of support are available.

2.04 Code Red – Fire

2.05 Code White – Hazardous Material / Chemical Spill

2.06 Control Facility – the County of Sacramento has designated UCDMC as the Control Facility for Sacramento County. The Control Facility coordinates medical control of patients and victims dispersal to hospitals in the community/region.

2.07 External Disasters – those disasters taking place in the community or region or in UCDMC facilities other than the Main Hospital, Trauma Nursing Unit (TNU) (Building 94) or Building 64.

2.08 Internal Disasters – those disasters taking place within the Main Hospital, TNU (Building 94) or Satellite Surgery Suite (SSS, Building 64).

2.09 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 Medical Center 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 UC Davis Medical Center campus are as follows.

1. Emergency Telephone Numbers
   a. SMUD (Electrical) 916-732-7119
   b. PG&E (Gas) 800-745-5000
   c. Sacramento Water District (Water) 916-264-5011

END OF SECTION 01340
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 01110 – SUMMARY OF THE WORK
C. Section 01310 – COORDINATION
D. Section 01320 – CONTRACT SCHEDULES
E. Section 01560 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS
F. Section 01561 – AIRBORNE CONTAMINANTS CONTROL
G. Section 01730 – CUTTING AND PATCHING
H. Section 01740 – 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) 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 days that is confined to a single smoke compartment or fire zone will not merit for declaring a hospital-wide ILSM(s) but would require reduction in flammable and combustible loads in the affected smoke compartment or zone as well as issuing a work order to complete the Plan For Improvement (PFI) within 45 days of discovery.

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

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

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

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

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

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

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

5. ILSM example #5: Provide additional firefighting equipment and use training for construction workers.
6. ILSM example #6: No smoking. Contractor shall follow the Universities smoking policy.

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

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

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

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

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

1.04 SECURITY PROCEDURES

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

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

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

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

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

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

1.05 HAZARDOUS MATERIALS PROCEDURES

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

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

C. PRODUCTS – Not Applicable to this Section

D. EXECUTION – Not Applicable to this Section

END OF SECTION 01350
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. Office of Statewide Health Planning & Development Projects

1.02 RELATED SECTIONS

A. Section 01350 – SPECIAL PROCEDURES
B. Section 01420 – REFERENCES
C. Section 01450 – 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:

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

   a. 2016 California Administrative Code, California Code of Regulations – Title 24, Part 1
b. 2016 California Building Code, California Code of Regulations – Title 24, Part 2, Volume 1


d. 2016 California Electrical Code, California Code of Regulations – Title 24, Part 3

e. 2016 California Mechanical Code, California Code of Regulations – Title 24, Part 4

f. 2016 California Plumbing Code, California Code of Regulations – Title 24, Part 5

g. 2016 California Energy Code, California Code of Regulations – Title 24, Part 6

h. 2016 California Elevator Safety Construction Code, California Code of Regulations – Title 24, Part 7

i. 2016 California Historical Building Code, California Code of Regulations – Title 24, Part 8

j. 2016 California Fire Code, California Code of Regulations – Title 24, Part 9

k. 2016 California Existing Building Code, California Code of Regulations – Title 24, Part 10

l. 2016 California Referenced Standards Code, California Code of Regulations – Title 24, Part 12

m. 2016 NFPA 13 – Standard for the Installation of Sprinkler Systems

n. 2016 NFPA 14 – Standard for the Installation of Standpipe and Hose System

o. 2016 NFPA 72 – National Fire Alarm and Signaling Code

p. 2016 NFPA 80 – Standard for Fire Doors and Other Opening Protectives

q. 2018 NFPA 99 – Health Care Facilities Code


s. 2017 NFPA 252 – Standard Methods of Fire Tests of Door Assemblies


u. California Code of Regulations, Current Editions:

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

v. Americans with Disabilities Act (ADA) 2010
w. OSHPD code applications notices and policy intent notices
x. Rules and regulations of private and public utilities
y. American National Standards Institute (ANSI)
z. American Society of Testing Materials (ASTM)
aa. Federal Specifications (Fed. Spec.)
bb. Underwriters Laboratories
c. National Fire Protection Association (NFPA) (as adopted by State agencies)
d. Traffic controls per California MUTCD requirements

2. All dates to comply with edition 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.


### 1.05 PROJECT INSPECTIONS

A. Provision of inspectors by University, if any, or by Office of Statewide Health Planning and Development pursuant to this Section and Section 1.4 above shall be subject to the following:

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

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

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

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

### 1.06 DEFERRED APPROVAL

A. Where noted in the Contract Documents, certain items of materials and/or systems may require 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 01410
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 01410 – 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 of the 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. 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.

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

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

9. 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.

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

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

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


13. 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.

14. Noted: Same as indicated.

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

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

17. Products: Materials, systems or equipment.

18. Project site: Same as site.
19. 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.

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

21. 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.

22. 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.

23. Scheduled: Same as indicated.

24. 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.

25. Shown: Same as indicated.

26. 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.

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

28. 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.

29. 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 America
Al Asphalt Institute
AIA American Institute of Architects
AICA 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
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
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
MLSFSA 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
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 01420
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 responsibilities in inspections and tests
H. Contractor responsibilities regarding UCDMC testing laboratory
I. Test reports
J. Geotechnical engineer

1.02 RELATED SECTIONS

A. Section 01310 – COORDINATION
B. Section 01410 – REGULATORY REQUIREMENTS: Compliance with applicable codes, ordinances and standards.
C. Section 01455 – INSPECTION OF WORK
D. Section 01610 – 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 necessary 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.

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 University's 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.

1.08 INSPECTION BY INDEPENDENT TESTING AND INSPECTION LABORATORIES

A. Definitions:

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

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

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

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

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

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

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

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

4. Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design.

E. Test and inspections shall include, but not be limited to, test and inspections seen in the TIO.

F. Test and Inspection Reports: After each inspection and test, one (1) copy of 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 01455 – INSPECTION 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 UCDMC 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) copy of all reports to University's Representative, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01450
PART I - GENERAL

1.01 DESCRIPTION

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

1.02 QUALITY ASSURANCE

A. ASTM standards
B. 2016 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.

PART II - PRODUCTS

2.01 SEISMIC RESTRAINT REQUIREMENTS

A. SUMMARY

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

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

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

B. SEISMIC RESTRAINT DESIGN

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

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

c. Design shall consider seismic relative displacement in accordance with ASCE 7-10 – 13.3.2.

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

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

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

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

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

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

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

a. Project specific cover letter clearly indicating that said engineer has (with respect to the attached submittal for omission of seismic restraints) completely review the project documents including these specifications, the items/systems designs individually and in coordination with all other trades, and that all code and/or project specified requirements for omission of restraints have been meet individually and in combination with each other, that (if the attached submittal for omission is approved) said engineer has been hired/retained by contractor to visit the project site without limit to review and inspect the installation of the items/systems which have been reviewed and approved for installation without seismic restraints.

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

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

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

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

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

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

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

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

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

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

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

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

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

C. ACCEPTABLE MANUFACTURERS

1. OSHPD pre-approved certified manufacturer (OPM)
D. ANCHORS, INSERTS AND FASTENERS

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

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

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

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

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

6. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or internally threaded anchors in concrete or metal decking with concrete fill without prior approval of the Project Manager.

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

PART III - EXECUTION

3.01 SEISMIC ANCHORING AND RESTRAINTS

A. Equipment anchors:

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

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

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

B. Conduit supports:

1. Conduits shall be supported and braced per CBC Title 24.
C. Lighting fixture supports:
   1. Provide independent seismic support system for all lighting fixtures.

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

3.02 INSTALLATION AND TESTING OF MECHANICAL ANCHORS:

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

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

END OF SECTION 01452
PART I - GENERAL

1.01 SECTION INCLUDES
   A. Project Inspections and Procedures
   B. Scheduling Inspectors – Notification requirements

1.02 RELATED SECTIONS
   A. Section 01310 – COORDINATION
   B. Section 01320 – CONTRACT SCHEDULES
   C. Section 01350 – SPECIAL PROCEDURES
   D. Section 01410 – REGULATORY REQUIREMENTS
   E. Section 01450 – QUALITY CONTROL

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

1.04 PROJECT INSPECTIONS AND TESTING PROCEDURES
   A. Inspections: This Project is not under the jurisdiction of the Office of Statewide Health Planning and Development. The following inspections will be requested on this project, as
appropriate. Also see Part 3 for non-OSHPD inspection items or Part 3, Item 3.12 for OSHPD requirements.

1. Inspections required by the California Building Code
2. Inspections listed on the Testing, Inspection and Observation (TIO) form
3. Final inspections

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

1. Contractor shall properly plan and coordinate inspection requests. Schedule delays caused by Contractor's failure to plan and/or coordinate inspection requests will not be considered for adjustments to Contract Time or Contract Sum.

2. A complete set of stamped and approved Contract Drawings and Contract Specifications, including applicable shop drawings and building permit shall be available on site for review by the Inspector-of-Record. The Contractor, Subcontractors and other responsible parties shall be present during inspection walk-throughs. All areas of project scope shall be ready and accessible for inspection. Contractor shall provide access equipment as applicable for the inspector's needs.

3. A complete set of codes referred to in the approved plans must be maintained on the job at all times.

4. Contractor shall submit verified compliance reports as outlined in the California Administrative Code, Section 7-151.

1.05 SCHEDULING INSPECTIONS – NOTIFICATION REQUIREMENTS

A. Advance Inspection Notification: University's Representative for this project requires the following advance notifications to schedule appropriate inspection agencies at the project site.

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

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

3. Testing Laboratory Inspections: Twenty-four (24) hours.
   a. All testing laboratory and testing procedures must be scheduled by University's Representative. Inspections and/or testing directly scheduled by Contractor will not be accepted.
   b. Contractor will bear all costs associated with unauthorized inspections and testing.

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

B. Methods of Inspection Notification:

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

2. Faxed inspection requests will be accepted. University's Representative fax number is 916-734-1375. Notification time begins from date stamp of University's fax machine. Faxed notification requests received after normal business hours and/or received on non-normal workdays, as defined in Specification Section 01310 – COORDINATION, paragraph 1.07.F.4.A will begin notification time starting at 7:00 AM the following normal business day.

3. Emailed inspection requests will be accepted. University's Representative email address is fdc.inspectors@ucdmc.ucdavis.edu. Notification time begins from the date and stamp of the email, provided it is sent during normal business hours. Emailed inspection requests sent after normal business hours and/or received on non-normal workdays, as defined in Specification Section 01310 – COORDINATION, paragraph 1.07.F.4.A will begin notification time starting at 7:00 AM the following normal business day.

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

D. Re-inspections:

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

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION
Note: Part 3 describes typical inspection requirements for each individual inspector’s jurisdiction for non-OSHPD 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 3.12 for Testing, Inspection Observation for OSHPD.

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 job-site 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 job-site 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.
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 job-site 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).

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
   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).
   3. Lighting and Lighting Levels (517-22).
   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.
7. Identify circuits (Critical Care Areas) (517-19).

D. Miscellaneous Electrical Requirements

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

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.

END OF SECTION 01455
**INSPECTION REQUEST**

A/C #: OSHPD #: UCDHS IR #: Contractor IR #: Date:  
Project Name: Spec Section (s):  

<table>
<thead>
<tr>
<th>To: UC Davis Medical Center (UCDMC)</th>
<th>From:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities Design &amp; Construction – Inspection Trailer</td>
<td>Facility Design &amp; Construction – Inspection Trailer</td>
</tr>
<tr>
<td>4430 V Street, Building 35-A</td>
<td>4430 V Street, Building 35-A</td>
</tr>
<tr>
<td>Sacramento, CA 95817</td>
<td>Sacramento, CA 95817</td>
</tr>
<tr>
<td>P: 916-734-5060</td>
<td>P: 916-734-5060</td>
</tr>
<tr>
<td>F: 916-734-1375</td>
<td>F: 916-734-1375</td>
</tr>
<tr>
<td>Email: <a href="mailto:fdc.inspectors@ucdmc.ucdavis.edu">fdc.inspectors@ucdmc.ucdavis.edu</a></td>
<td>Email: <a href="mailto:fdc.inspectors@ucdmc.ucdavis.edu">fdc.inspectors@ucdmc.ucdavis.edu</a></td>
</tr>
</tbody>
</table>

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.):  

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:  

**UCDHS USE ONLY**

Date Received: Re-inspection Requested for Previous UCDHS IR #: Time of Inspection:  
Date of Inspection: Inspector:  
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)  

<table>
<thead>
<tr>
<th>Project Field Record of Construction Progress Summary of Work in Progress (Part 1, Chapter 7, Section 7-145, Item 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Phase (Building Foundation, Structural, Wall Framing, Electrical Rough-In, Sprinkler Rough-In, etc.)</td>
</tr>
</tbody>
</table>

Project Phase Percentage Complete (% of the phase completed): Overall Project Percentage Complete:
NON-CONFORMING WORK NOTICE

A/C #: ______________________  OSHPD #: ______________________  Notice #: ______________________  Date: ______________________

To: ________________________________________________________________  From: UC Davis Medical Center (UCDMC)

Facilities Design & Construction – Inspection Trailer

4430 V Street, Building 35-A

Sacramento, CA 95817

P: ______________________  F: 916-734-1375

Email: fdc.inspectors@ucdmc.ucdavis.edu

Spec Section Ref.: ______________________  Paragraph: ______________________  Drawing Ref.: ______________________

Detail:

____________________________________________________________________

____________________________________________________________________

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

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Reported by: _________________________________________________________

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

Description of corrective action taken:

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Accepted by: __________________________________________  Date: ______________________

CC: ______________________
SECTION 01510
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.

1.02 RELATED SECTIONS
A. Section 01110 – SUMMARY OF THE WORK
B. Section 01350 – SPECIAL PROCEDURES: General requirements for temporary facilities and controls, to accommodate UCDMC occupancy and use of the areas and spaces adjacent to construction.
C. Section 01561 – AIRBORNE CONTAMINANTS CONTROL
D. Section 01740 – CLEANING
E. Section 01770 – 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.

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 01740 – CLEANING.

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

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

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

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

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

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

B. Distribution requirements:

1. Wiring, connections and protection for temporary lighting.

2. Wiring connections and protection for temporary and permanent equipment, for environmental control, for temporary use of electricity operated equipment, and for testing.
C. Use of University System: If alternate electrical power and lighting sources are unavailable, University may permit Contractor to use existing, in-place electrical system. University does not guarantee availability of electrical power or adequate lighting levels through use of existing system. If power and lighting is insufficient or not available Contractor shall provide secondary source (i.e. generator) as approved by University.

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

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

3. When use of University electrical system is approved in writing, Contractor is required to adhere to University's electrical lockout procedures. See Division 16 – Electrical.
   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.

D. 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.

1.05 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 15 for requirements.

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 ¾” 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.

1.06 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 01350 – SPECIAL PROCEDURES.

1.07 TEMPORARY TELEPHONE

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 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 service.

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

4. Contractor shall prepare and submit to University, "UNIVERSITY TELECOMMUNICATION TELEPHONE SERVICE FOR OUTSIDE CONTRACTORS" form. Refer to attached form at end of this section.

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

C. Contractor Phone:

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

D. Telephones:

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

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

   a. Life Flight or CHP helicopters.

   b. Emergency Service vehicle communications.

d. Microwave transmission stations.
e. UCDMC closed-circuit television or radio signals.
f. Cellular or other mobile phone systems in main hospital.
g. UCDMC voice or digital paging systems.

PART II - PRODUCTS

2.01 MATERIALS

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

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

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

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01510
UC Davis Health System
Telephone Service for Construction Trailers/Work Sites

UCDMC Project Managers

When construction bids are awarded, please include this form in the project packet. Contact Jim Fralick at 916-734-3399 or Amy Yee at 916-734-8000 in Telecommunications to verify the correct termination point for each project.

CONTRACTORS

To order telephone service for your construction site at UC Davis Medical Center, please use the following instructions – see page 2 for additional information:

- Call AT&T at “800-750-2355” to order your telephone lines. You will need to give them the following information:
  - Bring service to: 2315 Stockton Blvd, Sacramento, CA – 1.1 MPOE, Admin Bldg (or other location as designated)
  - Site contact person: Amy Yee, 916-734-8000
  - Request the installer to call Amy Yee with binding post information
- AT&T will provide the new assigned telephone numbers, an order number and the installation date.
- Enter the information onto the form below.
- Fax the completed form to: UC Davis Medical Center, Telecommunications
  Fax # 916-456-8331
  Attention: Amy Yee – 916-734-8000
  amyyee@ucdavis.edu

Date: ___________  Project Name: ________________________________
Company Name: _______________________________________________
Contact Name: ___________________________________________________
Phone or Cellular #: __________________________ Email address: ____________________________
Location of construction site: ______________________________________
UCDHS Project Manager: ___________________________ Phone #: ________________

AT&T Order Information

Telephone number assignments: ______________________________________

AT&T Order #: ___________________________ Pacific Bell due date: ______________

Note: This form is to be used for ALL telephone services ordered for this project, including Fax Lines, Modem/DSL Lines and Payphones.
The following are typical telephone system safety practices required by the subs to get site-accessed phone, T1, DSL and fax services:

1. Cabling from the University splice point to the trailer needs to be "pic" (gel filled) outside plant cable (Superior Essex-Sealpic-24 ga, 6, 12 pair, Graybar cut to length) protection against the elements and accidental faults. Requires 8-foot minimum pigtail at the splice box.

2. DMARC at trailer needs to have a primary protection module (Sec 800-30&41 CEC-2002, found at Graybar) with 2, 4, 6, 8, pair protection to receive the cable from the splice.

3. 1-8 foot copper coated ground rod placed at the trailer and wired by an electrician to the trailer power ground (building) and Telephone primary protector module.

UC Davis Medical Center contact for additional information: Jim Fralick – 916-734-3399
SECTION 01520
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 01110 – SUMMARY OF THE WORK
B. Section 01350 – 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 01740 – CLEANING
D. Section 01770 – CLOSEOUT PROCEDURES

1.03 FIELD OFFICES AND SHEDS

A. Contract Documents: Complete set of Contract Drawings and Contract Specifications shall be kept continuously at the site. Copies of all Change Orders, letters, Shop Drawings, etc., shall be kept on the job-site at all times and shall be available for inspector's use.
B. Contact numbers: Contractor shall provide telephone numbers where Contractor may be reached at all times during normal working hours and also after normal working hours, if emergency problems develop that require Contractor's assistance.
C. Cleaning: Weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas. Contractor shall keep construction loading and parking areas clear of construction debris, especially debris that may cause slipping or tripping hazard that may injure vehicle tires, that may stain surfaces, and that may be tracked into existing buildings. Maintain approach walks free of mud and water.
D. Removal: Upon completion of the work, and before the final payment, Contractor shall remove all temporary work and facilities and return site to condition required by the General
Conditions of the Contract and at no change to the Contract Sum or the Contract Time.

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.

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 01520
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 01110 – SUMMARY OF THE WORK
B. Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
C. Section 01350 – 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 01740 – CLEANING
E. Section 01770 – CLOSEOUT PROCEDURES: Project Closeout.

1.03 PARKING AREAS AND ACCESS ROADS

A. Access Roads: Existing roads shall be used for construction access within limits defined herein. Temporary construction access roads shall not be permitted.
B. Parking: Parking is controlled and limited by University.

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

2. All permits must be purchased on cash basis.

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

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

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, 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

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

B. Maintain signs and supports: Clean, repair deterioration and damages.

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

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01550
SECTION 01560
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 01110 – SUMMARY OF THE WORK
B. Section 01350 – SPECIAL PROCEDURES
C. Section 01561 – AIRBORNE CONTAMINANTS CONTROL
D. Section 01740 – 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 metal studs spaced 24” o/c maximum and covered on both sides with ⅝” thick Type-X rated gypsum wallboard taped, braced so to be self-supporting without fastening to existing finishes.

   a. Provide gaskets of closed cell neoprene, or strips of fiberglass insulation between barriers and existing finish.

   b. Finish exposed surfaces with two (2) coats of paint (color as selected by University), maintain in neat, orderly appearance and paint barrier on public side. Temporary emergency exit and or directional signage indicating Emergency Exits will be furnished and installed by Contractor.

   c. Provide temporary doors in corridors with twenty (20) minute fire-rated assemblies and locksets to limit use.

   d. Use of access doors and routes by workmen to be approved by University's Representative.
2. **Fire Retardant Enclosures - Non-Rated Assemblies**: Provide non-combustible dust-proof barriers framed with metal studs and covered on public side with Fire Retardant plastic laminate sheathing material. Flame spread 10 - smoke development 45 - fuel contribution undeterminable, as manufactured by Reef Industries, Inc., P.O. Box 33248, Houston, TX 77033 or equal.
   
   a. Joints shall be taped and sealed over framing studs.
   
   b. Bracing shall be self-supporting without fastening to existing finishes.
   
   c. Provide gaskets of closed cell neoprene, or strips of fiberglass insulation between barriers and existing finishes.
   
   d. Provide non-staining taped seal to surrounding materials to insure seal.
   
   e. **Non-Rated Assemblies for Dust Control**: Use ½" Type-X or equal gypsum wallboard applied on occupancy side on framing member. Joints over studs shall be taped and sealed. Other detail similar to 1.03-B.2 above.

C. **Removal**: Remove temporary materials, equipment and construction at completion; repair damage caused by installation or use of barricades and enclosures. Restore existing facilities used during construction to specified, or to original condition.

1.04 **DIESEL VEHICLE/EQUIPMENT IDLING PROCEDURES**

A. When drivers of diesel powered on-road vehicles arrive at loading or unloading areas to drop-off or pick-up passengers, supplies, equipment, materials, etc., they shall turn off their vehicle’s engine as soon as possible but no later than five minutes after arrival.

B. Operators of off-road diesel powered equipment shall turn off their engines when the equipment is not performing its primary function, but no later than five minutes after the equipment has come to a stop.

C. Idling for “warm-up” prior to diesel vehicle or equipment operations on UCDMC 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 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 UCDMC 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 01350 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 Medical Center, as directed by University, to be selectively sorted by 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 water-
courses. Silt deposited as a result of the Work shall be removed and disposed of by Contractor at no cost to University.

1. Rough grade site to prevent standing water and to direct surface drainage away from excavations, trenches, adjoining properties and public right-of-ways.

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. 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 job-site.

PART II - PRODUCTS – Not Applicable to this Section

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, (no known equal).

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01560
ICRA Permit Number | ICRA Class
---|---
Job # and Name | Project Manager
Estimated Start | Estimated Completion

**ACKNOWLEDGEMENT OF HAZARDOUS MATERIALS**

Does the project contact hazardous materials (e.g., asbestos, lead, mold, PCBs, mercury)? Yes / No

Verified How: (e.g., hazmat survey, personal knowledge)

By Whom: (name & department)

**CONTAINMENT STRATEGIES**

<table>
<thead>
<tr>
<th>Enclosure Types</th>
<th>check all that apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Containment (poly over all surfaces not in SOW)</td>
<td>Hard Barriers Required</td>
</tr>
<tr>
<td>Isolated Room – Critical Openings Only (seal doors, supply and return registers, etc)</td>
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</tr>
<tr>
<td>Mini Containment Cube (only large enough for 1-2 people; aka pop up cube)</td>
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<tr>
<td>Shrouded Tool with HEPA filtered exhaust</td>
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<tr>
<td>Glove Box Containment with HEPA filtered exhaust</td>
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<tr>
<td>Other:</td>
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</tbody>
</table>

**Negative Pressure Requirements** [check all that apply]

-0.020” wc at all times (24/7) as displayed on mounted manometer
-0.020” wc at setup with some negative pressure throughout project as displayed on manometer
Visual Verification of some negative pressure throughout project
No negative pressure required
Negative pressure in localized HEPA exhausted work area (e.g. shrouded tool, glove box)
Other:

**Negative Pressure Equipment** [check all that apply]

Onsite Challenge Testing (DOP or particle counting) prior to setup
Challenge Tested within last 6 months; Equipment has remained onsite at UCDMC
Single HEPA Unit; exhausted to: □ Outdoors □ Diffusion Box/Chamber
Two HEPA Units in Parallel; exhausted to: □ Outdoors □ Diffusion Box/Chamber
Other:

**Additional Containment Requirements** [check all that apply]

<table>
<thead>
<tr>
<th>Ante Room</th>
<th>Masonite Floor Protection</th>
<th>Protective Clothing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk off mats</td>
<td>Shoe Covers</td>
<td>Air Scrubber</td>
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<tr>
<td>Other:</td>
<td></td>
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**VERIFICATION OF WORK**

<table>
<thead>
<tr>
<th>Type(s) of Inspection Required</th>
<th>Responsible Party</th>
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<tbody>
<tr>
<td>HEPA Equipment Verification</td>
<td>□ EH&amp;S □ Consultant □ Other:</td>
</tr>
<tr>
<td>Pre-Work Approval Inspection</td>
<td>□ EH&amp;S □ Consultant □ Other:</td>
</tr>
<tr>
<td>Daily Onsite Oversight</td>
<td>□ PM □ EH&amp;S □ Consultant □ IOR □ Other:</td>
</tr>
<tr>
<td>Air Sampling Type:</td>
<td>□ EH&amp;S □ Consultant □ Other:</td>
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<tr>
<td>Frequency:</td>
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<tr>
<td>Demolition Inspection</td>
<td>□ PM □ EH&amp;S □ Consultant □ IOR □ Other:</td>
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<tr>
<td>ICRA Downgrade</td>
<td>□ PM □ EH&amp;S □ Consultant □ IOR □ Other:</td>
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<tr>
<td>Final Visual Approval Inspection</td>
<td>□ PM □ EH&amp;S □ Consultant □ IOR □ Other:</td>
</tr>
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</table>
## Initial Information and Benchmark Containment Inspections – Appendix B

<table>
<thead>
<tr>
<th>ICRA #</th>
<th>Location</th>
<th>Set Up Date</th>
<th>Electrical Shop Inspection</th>
<th>Pre-Start Inspection (Name, Date, Time)</th>
<th>Post-Demo Inspection (Name, Date, Time)</th>
<th>Downgrade Inspection (Name, Date, Time)</th>
<th>Final Inspection (Name, Date, Time)</th>
<th>Take Down Date</th>
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### Daily Inspection Log

<table>
<thead>
<tr>
<th>Date &amp; Time</th>
<th>Performed By (Name)</th>
<th>Pressure Reading (+/-)</th>
<th>Acceptable Negative Pressure? (Y/N)</th>
<th>ILSM conditions still met? (Y/N/n/a)</th>
<th>Tack Mat useable? (Y/N)</th>
<th>Interior free of dust/debris? (Y/N)</th>
<th>Containment Integrity Intact (no holes or breaches)? (Y/N)</th>
<th>All ICRA permit conditions met? (Y/N)</th>
<th>Other Issues? (Explain)</th>
<th>Corrective Actions</th>
</tr>
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<tbody>
<tr>
<td>Example 7/4/16 – 0800</td>
<td>B. Clean</td>
<td>-0.025</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>closed entry door</td>
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<tr>
<th>Date &amp; Time</th>
<th>Performed By (Name)</th>
<th>Pressure Reading (+/-)</th>
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01560 - 7
TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS
01/2018 Edition
ENTRY WARNING SIGN WITH PROJECT MANAGER CONTACT INFORMATION – APPENDIX C

CAUTION

CONSTRUCTION DUST PRECAUTIONS IN USE
DO NOT ENTER

For More Information Contact the Project Manager

_____________________________________
(Name)

_____________________________________
Phone Number

(THIS SIGN MUST BE POSTED IN COLOR)
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 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
B. Section 01410 – REGULATORY REQUIREMENTS
C. Section 01450 – 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 01450 – QUALITY CONTROL and other Sections in Division 2 through 16 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 or University Standard" 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 (30) days after the date of commencement of the Work specified in the Notice to Proceed, a typewritten list containing 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 thirty (30) 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 thirty (30) 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 thirty (30) 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 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 minimum of four (4) copies.

   b. In reviewing supporting data for substitution, University will use, for purpose of comparison, all characteristics of 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. Furnish list of Subcontractors, if any, that may be affected by the substitution.

4. 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.

5. 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.

6. 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.

END OF SECTION 01610
REQUEST FOR SUBSTITUTION

Substitution #: __________________ Submittal #: ______________ Date: ______________

A/C #: __________________________ OSHPD #: __________________

PROJECT NAME: __________________

TO: UC DAVIS MEDICAL CENTER FROM: __________________

Facilities Design & Construction
4800 2ND Avenue, Suite 3010
Sacramento, CA 95817
P: 916-734-7024
F: 916-734-7751
Attn.: Project Manager

Name of Party Submitting Request for Substitution: __________________

Reason for Submitting Request for Submission: __________________

Specification Section and Paragraph #: __________________

Substitution Manufacturer name and address: __________________

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

Fabricators and Suppliers (as appropriate): __________________

PRODUCT DATA:
ATTACH PRODUCT DATA AS SPECIFIED IN SPECIFICATION SECTION 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

-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 01730
CUTTING AND PATCHING

PART I - GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching Work.

1.02 RELATED SECTIONS

A. Section 01110 – SUMMARY OF THE WORK

B. Section 01310 – COORDINATION

C. Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

D. Section 01610 – PRODUCT REQUIREMENTS

E. 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) 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.


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 A/C 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 http://ww.ucdmc.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 OSHPD 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 01350 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 01610 – PRODUCT REQUIREMENTS.
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.

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.

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.

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 work day. Closures shall be approved by the University Fire Marshal.

G. Refinish surface to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish unit.

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.

END OF SECTION 01730
CORING / SAWCUTTING NOTIFICATION

LOCATION: ___________________________ A/C: ___________________________

TRACKING NUMBER: ___________________ TITLE: ___________________________

(Provided by PO&M)

OSHPD #: ___________________ DATE: ______________________

TO: Facilities Design & Construction
    UC Davis Medical Center
    4800 2nd Avenue, Suite 3010
    Sacramento, CA 95817
    P: 916-734-7024
    F: 916-734-7751

Attn.: Derek Beyer

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: ______________________

UCDMC USE ONLY

DATE RECEIVED:

WHO FROM UCDMC WILL AUTHORIZE, SUPERVISE AND VERIFY?

PHONE:

Utilities Verified by IOR? YES NO

Activities coordinated with:

□ PO&M □ Fire □ Telecom □ Occ. Safety □ Other (Itemize):

COMMENTS:

Signed: ___________________________

DATE AUTHORIZED: ___________________ 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 01740
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 01561 Airborne Contaminants Control have procedures and practices that shall be implemented and followed by the Contractor for this project.

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.

3. 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.

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

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

6. 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. Any dust or debris tracked out of construction site, either by foot traffic or by debris hauling vehicles, at University option, shall be cleaned and removed by Contractor at no additional cost to the University.

B. Conduct cleaning and disposal operations in compliance with 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. Clean walkways, driveways and streets by thorough brooming and wash-down.

C. Clear debris from storm drainage lines and ways, leaving site ready for stormy weather.

D. Rake landscaped areas clean.

E. Remove waste and surplus materials, rubbish and temporary construction facilities, utilities and controls.

F. Disinfect containment and protection areas as directed by University Representative.

G. 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 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. Cleaning of Work provided by University under separate contracts, will not be required except if soiled by construction activities under this Contract.

I. Thoroughly clean and polish all resilient flooring, metal and plastic surfaces; remove labels and protective coatings.

J. Replace filters and clean heating and ventilating equipment used for temporary heat and ventilation.

K. 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.

L. 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. 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 final completion or University use of premises, 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 01740
SECTION 01760
PROTECTING 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 and Interference.

1.02 RELATED SECTIONS

A. Section 01310 – COORDINATION
B. Section 01510 – TEMPORARY UTILITIES

1.03 EXISTING ITEMS

A. Existing furniture: Protect any existing furniture that is affected by construction. Contractor shall exercise care in avoiding damage to existing facilities. Contractor shall be responsible for repair of same if damaged through Contractor's action.

B. 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.

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. 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.

E. 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.
F. 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 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.

F. 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. Lay planking or similar rigid materials in place in areas subject to movement of heavy objects and where storage of products will occur.

G. 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.

H. Lawns and Landscaping: Restrict traffic of any kind across planted lawn and landscaped areas.

I. Adjacent Facilities: Care shall be exercised to prevent damage to adjacent facilities including walks, curbs, and gutters. Planking 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.
J. 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.

K. 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.

L. 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.

M. 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.

N. 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.

O. Protective Coatings: Remove protective coatings, etc., as required to leave work in condition for painting and finishing, final cleaning, etc.

P. Exterior Work: Protect all exterior work, including existing asphalt paving and landscaping and buildings.

END OF SECTION 01760
SECTION 01770
CLOSEOUT PROCEDURES

PART I - GENERAL

1.01 SECTION INCLUDES
   A. Project Closeout Procedures
   B. Contract Closeout Procedures

1.02 RELATED SECTIONS
   A. Section 01310 – COORDINATION
   B. Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES: Administrative general requirements for submittals.
   C. Section 01560 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS: Removal of Controls.
   D. Section 01740 – CLEANING: Final Cleaning.
   E. Section 01780 – 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. Change building locks from construction to permanent keying, as directed by University's Representative.
   D. Complete start-up testing 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: At Contractor’s request, University's Representative will attend preliminary contract closeout review, not later than fourteen (14) calendar days prior to anticipated Substantial Completion review date.
      1. Contractor shall provide at preliminary review a typewritten list (Preliminary Punch List) of items to be completed and corrected.
      2. 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).
      3. Segregate architectural, plumbing, HVAC and electrical Work on separate lists.
4. 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 tested, adjusted and balanced and are fully operational.
   e. Operation of systems has been demonstrated to University personnel.
   f. Work is ready for University's Consultant's Substantial Completion review.

2. Provide minimum seven (7) working days notice to University's Representative prior to desired date for Punch List review.

C. 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 re-type 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.

D. Uncorrected Work: Refer to requirements specified in SECTION 01450 – QUALITY CONTROL regarding Contract adjustments for non-conforming work.

E. Cleaning and Clearing: Prior to Substantial Completion review, execute cleaning and clearing of temporary facilities and controls, as specified in SECTION 01560 – TEMPORARY BARRIERS, ENCLOSURES AND CONTROLS.
F. Testing and Inspection: Prior to Substantial Completion review, complete all tests and inspections and submit applicable reports and approvals.

1. Complete materials tests and inspections.
2. Complete testing, inspection, balancing, sterilization and cleaning of plumbing and HVAC systems.
3. Complete testing and inspection of electrical system.
4. Complete operational tests of equipment.

G. Consultant's Certification: University's Consultant will complete and issue notice of Substantial Completion on American Institute of Architect's Form G704 – CERTIFICATE OF SUBSTANTIAL COMPLETION.

1. Certificate will be completed when University's Consultant determines that list of items to be completed and corrected (Punch List) are sufficiently complete for University to occupy Project for the use intended.
2. University's Consultant will forward copies of completion certification to University and Contractor.
3. IF OSHPD PROJECT: Submit two (2) originals of Contractor's Final OSHPD Verified Reports to University's Representative certifying completion of the Work in conformance with the Contract Documents. Report forms will be supplied by University's Representative.

H. Acceptance of the Work shall not relieve Contractor of any responsibility for defects that develop during the guarantee period and are caused by Contractor's failure to perform work in accordance with requirements of Contract Documents.

1.05 FINAL COMPLETION SUBMITTALS

A. Evidence of Compliance with Requirements of Governing Authorities:

2. Compliance Notification: In conformance with State of California Energy Conservation Standards, Contractor shall, at time of request for final inspection, issue to University's Representative notarized certificate stating completed work appears, in every material respect, to be in compliance with approved Contract Documents. Provide only if specifically required.

B. Final Specifications Submittals: Submit to University's Consultant all documents and products required by Specifications to be submitted, including the Following:

1. Project Record Drawings: Submit under provision of SECTION 01780 – CLOSEOUT SUBMITTALS.
2. Operation and Maintenance Data: Submit under provision of SECTION 01780 – CLOSEOUT SUBMITTALS.
4. Spare Parts and Maintenance Materials: Submit under provision of SECTION 01780 – CLOSEOUT SUBMITTALS.

5. Keys and Keying Schedule: At completion of Project, all keys shall be returned to University's Representative. Failure to return a key will obligate Contractor for all costs of re-keying facility.

C. Certificates of Compliance and test Report Submittals: Submit to University's Representative certificates and reports as specified and required, including the following:

1. Sterilization of water system
2. Sanitary sewer system tests
3. Gas system tests
4. Lighting, power and signal system tests
5. HVAC equipment and air balance tests

D. Lien and Bonding Company Releases: Submit to University's Representative, copies of all conditional and unconditional general/subcontractor lien releases showing satisfaction of encumbrances and release of liens of Project by completion and submission of Exhibits of the General Conditions of the Contract, as applicable. Signatures shall be notarized.

E. Subcontractor's List: Submit to University's Representative five (5) copies of updated Subcontractor and Materials Supplier List.

F. Warranty Documents: Prepare and submit to University's Representative all warranties and bonds as specified in SECTION 01780 – CLOSEOUT SUBMITTALS.

1.06 STATEMENT OF ADJUSTMENT OF ACCOUNTS

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

1. Original Contract Sum
2. Previous Change Orders
3. Changes under allowances
4. Changes under unit prices
5. Deductions for uncorrected work
6. Penalties
7. Deductions for liquidated damages
8. Deductions for re-inspection fees
9. Other adjustments to Contract Sum
10. Total Contract Sum as adjusted
11. Previous payments

12. Sum remaining due

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

1.07 APPLICATION FOR FINAL PAYMENT

A. Final Payment: After completion of all items listed for completion and correction, after submission of all documents and products, and after final cleaning, submit final Application for Payment, identifying total adjusted Contract Sum, previous payments and sum remaining due. Refer to SECTION 01290 – MEASUREMENT AND PAYMENT and the General Conditions of the Contract.

B. Submit Record Documents to University's Representative with final Application for Payment.

1.08 PROJECT AS-BUILT DOCUMENTS

A. Maintain on site, one (1) set of the following as-built documents and record actual construction and all revisions to the Work:

1. Contract Drawings

2. Contract, with Specifications, Addenda, Change Orders, and modifications to the Contract.

3. Approved shop drawings, product data and samples.

4. Store As-built Documents separate from documents used for construction.

B. Drawings: Record information continuously as Work progresses. Do not conceal Work permanently until required information is recorded.

C. Specifications: In PART 2 – PRODUCTS in each Section, legibly mark and record actual Products installed or used, including:

1. Manufacturer, trade name, product model or catalog number and supplier of each product or item of equipment installed.

2. Product substitutions or alterations utilized.

3. Changes made by Addenda, Modification, Change Order, Field Order, and clarifications or interpretations made by Letter of Instruction.
D. As-built Drawings: Keep up to date during entire progress of the Work and make available to University at any time. Recording of the As-built condition shall be carefully and neatly done by a competent drafter, familiar with the trade involved, using methods acceptable to University's Representative. Legibly and to scale, mark a reproducible set of Contract Drawings to record all changes in size, location, and other features of installation in the actual construction, including:

1. Measured depths of foundations and footings encountered, measured in relationship to finish First Floor datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent ground improvements.
   a. Locations of work buried under or outside building footprint, such as plumbing and electrical lines and conduits.
   b. Record all locations of underground work, points of connection, valve locations, manholes, catch basins, capped stub-outs, invert elevations, etc.

3. Field changes of dimension and detail.
   a. Locations of all significant work concealed inside building, the locations of which are changed by Contractor from those shown on Contract Drawings.
   b. Locations of all items, not necessarily concealed, which vary from locations shown on the Contract Drawings.
   c. Record sufficient information so that concealed work may be located with reasonable ease and accuracy.

4. Actual numbering of each electrical circuit.

5. Details not on original Contract Drawings.

6. Additional drawings as required to properly describe changes.

7. Reproducible set of Contract Drawings will be provided to Contractor by University's Representative.

E. Shop Drawings: Provide reproducible Record copy, made from final Shop Drawings, updated to show actual conditions for work specified in individual Sections.

F. Large Scale Drawings: Divisions 15 and 16 of the Contract Specifications require preparation of large-scale, detailed layout drawings for the work of those Divisions. These layout drawings are not shop drawings as defined by the General Conditions of the Contract but together with Shop Drawings or layout drawings of all other affected sections, are used to check, coordinate and integrate the Work of the Various Sections. Maintain and submit these layout drawings as part of the Project Record Drawings.

G. Acceptance: All Record Documents are subject to review and acceptance by University.
PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01770
SECTION 01780
CLOSEOUT SUBMITTALS

PART I - GENERAL

1.01 SECTION INCLUDES

A. Equipment Data
B. Operation and Maintenance Instructions
C. Instruction of UCDMC 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 01310 – COORDINATION
B. Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
C. Administrative general requirements for submittals.
D. Section 01450 – QUALITY CONTROL: Manufacturer's tests and inspections as a condition of warranty.
E. Section 01610 – PRODUCT REQUIREMENTS
F. Section 01770 – CLOSEOUT PROCEDURES

1.03 EQUIPMENT DATA AND OPERATION AND MAINTENANCE 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

1. **Binders**: Commercial quality, 8-1/2” x 11”, three-ring binders with hardback, cleanable, plastic covers; 1” minimum, 1-1/2” maximum ring size. Provide separate binders, submitted separately for each discipline, i.e. Site Work, Doors and Windows, Conveying Systems, Mechanical, Plumbing, Electrical, etc. Correlate data into related consistent groupings. Provide two (2) copies of data in Adobe PDF format on CD as well.

2. **Cover**: Identify each binder with typed or printed title "EQUIPMENT DATA AND OPERATION AND MAINTENANCE INSTRUCTIONS".
   
a. List Project title and Project number and particular building as applicable.
   
b. Identify contents.

3. **Organization**: Arrange content by systems under Section numbers and sequence in accordance with the Project Specifications Table of Contents. Provide tabbed flyleaf for each separate product and system with typed description of product and major component parts of equipment.

4. **Text**: Manufacturer's printed data or typewritten data on 20 pound paper.

5. **Drawings**: Provide with reinforced punched binder tabs. Bind in with text; fold larger drawings to size of text page. Do not hole punch drawings. Insert drawings in clear plastic holder.

C. **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 Record 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 01450 – QUALITY CONTROL.

5. **Warranties and Bonds**: Bind in copy of each.

D. **Manual for Materials and Finishes**:

1. **Building Products, applied Materials, and Finishes**: 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.


5. Table of Contents: Provide a listing in Table of Contents for design data, with tabbed binder divider page and space for insertion of data.

E. 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 bound sets 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. Print information on heavy white paper, tab properly and identify for each reference. Submit drafts for review before preparing final sets, six (6) copies required.

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 data may not 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 trouble-shooting; 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 in SECTION 01810 – TESTING, ADJUSTING AND BALANCING PROCEDURES.


F. 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.

G. Equipment Data and Operation and Maintenance Instructions Submittals:

1. Submittals: Comply with administrative requirements specified in SECTION 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

2. Preliminary Draft Submittal: Submit two (2) copies of preliminary draft or proposed formats and outlines of contents no later than ten (10) days of equipment submittals approval. University’s Representative will review draft and return one (1) copy with comments.

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 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 three (3) copies of completed volumes in final form a minimum of ten (10) calendar days after final inspection.

1.04 SPARE PARTS 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.

B. Storage, maintenance: Store products with products to be installed in the Work, as specified in SECTION 01610 – 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.

1.05 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 16 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 subcontractors 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. UCDMC Recourse: Written warranties made to 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 two (2) original signed copies of each.

2. Table of Contents: Neatly typed and in orderly sequence, provide complete information for each items as follows:
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. Form of Submittal: Prepare in duplicate packets.
   1. Size: 8-½” x 11” sheets punched for 3-ring binder. Fold larger sheets to fit into binders.
   2. Identify each packet on cover with typed or printed title, "GUARANTEE AND BONDS", and the following:
      a. Title of Project
      b. Project Number
      c. Name of Contractor

E. Time of Submittals: Submit within ten (10) calendar days of Substantial Completion, 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.

F. Submittals Required: Submit guarantees, bonds, service or maintenance contracts specified in individual Sections of the Specifications.
   1. Contractor shall collect and assemble all written warranties and guarantees into a binder.
   2. Submit all required Warranties and Guarantees on letterhead of Contractor.

1.06 PROJECT RECORD DOCUMENTS

A. Maintenance of Record Documents and Samples:
   1. Provide complete set of Record Drawings and Specifications, showing every change from original Contract set, including all Addenda, Change Order, job decisions, etc. Prints for this purpose may be obtained from University's
2. When work is complete and prior to final payment, submit one (1) complete set of all record documents, marked to show any deviation from the original Contract set. These documents are to be an accurate description of all work as-built.

3. Prior to Application for final payment, a set of drawings shall be obtained from University's Representative and all changes, as noted on the Record Drawings shall be incorporated thereon. The set of drawings, together with one (1) copy therefrom, shall be delivered to University's Representative.

4. Label and file record Documents and samples in accordance with Section number listings in the Project Specifications Table of Contents. Label each document "PROJECT AS-BUILT" in neat, large, printed letters. Each document and sample shall include the University's Project title and Project number for reference purposes.

5. Maintain Record Documents in a clean dry and legible condition. Do not use Record Documents for construction purposes. Keep record Documents and samples available for inspection by University.

6. Record Schedule: Contractor shall provide Record Schedule of construction activities. Schedule shall be in same format as specified in SECTION 01320 – CONTRACT SCHEDULES.

B. Submittals: At Contract closeout, deliver Record Documents and samples as required by SECTION 01770 – CLOSEOUT PROCEDURES.

1. Transmit with cover letter in duplicate, listing:
   a. Date.
   b. Project title and Project number.
   c. Contractor's name, address and telephone number.
   d. Number and title of each Record Document.
   e. Signature of Contractor or authorized representative.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION – Not Applicable to this Section

END OF SECTION 01780
GUARANTEE

Project Title: ____________________________________________________________

Project Location: __________________________________________________________

Project Number: ______________________ DATE: ____________________________

GUARANTEE FOR ________________________________________________________ (the "Contract"),

between The Regents of the University of California ("University") and

_________________________________ ("Contractor").

(Name of Contractor or Subcontractor)

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

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

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

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

SUBCONTRACTOR

Signed: ___________________________ Title: _____________________________

Typed Name: ______________________________

Name of Firm: ______________________________________________________

Contractor License Classification & Number: ________________________________

Address: _____________________________________________________________

Telephone Number: ______________________________

CONTRACTOR

Signed: ___________________________ Title: _____________________________

Typed Name: ______________________________

Name of Firm: ______________________________________________________

Contractor License Classification & Number: ________________________________

Address: _____________________________________________________________

Telephone Number: ______________________________
# REPORT OF WORK REQUIRED BY WARRANTY

To: Keith Kanda, University Representative  
From:  

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

| Prepared by: ______________________________ | Signature: _______________ | Date: _______________ |
| (Print Name) | | |

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.
PART I - GENERAL

1.01 SECTION INCLUDES

A. Procedures for Adjusting and Balancing Systems

1.02 RELATED SECTIONS

A. Section 01450 – QUALITY CONTROL: Testing organization services.

B. Section 01750 – STARTING, AND ADJUSTING SYSTEMS: Starting and adjusting equipment prior to commissioning.

C. Section 15890 – DUCTWORK: Testing.

D. Section 15990 – PLUMBING/HVAC FINAL TESTING, ADJUSTING & BALANCE

E. General Conditions of the Contract: Inspections, tests and approvals required by governing authorities.

1.03 SUBMITTAL REQUIREMENTS

A. Service Provider: Prior to start of work, submit name or organization proposed to perform services. Designate managerial responsibilities for coordination of all testing activities.

B. Qualifications: Submit documentation to confirm organization qualifications.

C. Report Forms: Submit three (3) preliminary specimen copies of each report form proposed for use.

D. Final Report Submission: Fourteen (14) calendar days prior to completion submit three (3) copies of final reports. Submit reports of testing that are postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor’s control, promptly after execution of those services.

1.04 GENERAL PROCEDURES

A. Procedural Compliance: Comply with procedural standards of certifying association under whose standard services will be performed.

B. Notification: Notify University’s Representative, in writing, minimum of fourteen (14) calendar days prior to beginning service operation.

1. Record Keeping: Accurately record date for each step.

2. Report to University’s Representative any defects or deficiencies noted during performances of services.
1.05 FINAL REPORTS
A. Organization having managerial responsibility shall make reports.
B. Each Form shall bear signature of recorder, and that of supervisor of reporting organization.
C. Identify each instrument used and latest date of calibration of each.

1.06 CONTRACTOR RESPONSIBILITIES
A. Prepare each system for testing.
B. Coordinate with testing organization; provide access to equipment and systems. Operate systems at designated times, and under conditions required for proper testing.
C. Notify testing organization fourteen (14) calendar days prior to time system will be ready for testing.

PART II - PRODUCTS – Not Applicable to this Section

PART III - EXECUTION
3.01 PREPARATION
A. Provide instruments required for testing operations. Make instruments available to University to facilitate spot checks during testing. Retain possession of instruments and remove at completion of services.
B. Verify installation of system to be tested is complete and in continuous operation.
C. Verify ambient conditions and related facilities are in full operation.

3.02 SCHEDULE OF SYSTEMS REQUIRING TESTING SERVICES
A. Test piping at completion of roughing in, in accordance with the following schedule and show no loss in pressure or visible leaks after minimum duration under water pressure as set forth:

<table>
<thead>
<tr>
<th>TEST SCHEDULE SYSTEM TESTED</th>
<th>TEST PRESSURE PSIG</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating and Chilled Water Distribution System Connections</td>
<td>225 psig</td>
<td>4 Hours</td>
</tr>
<tr>
<td>Domestic Hot &amp; Cold Water Piping</td>
<td>150 psig at rough in</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Low Pressure Steam And Condensate</td>
<td>150 psig</td>
<td>2 Hours</td>
</tr>
<tr>
<td>High Pressure Steam</td>
<td>50% above Design Operation Pressure</td>
<td>4 Hours</td>
</tr>
<tr>
<td>Fire Sprinkler Piping Water</td>
<td>200 psig</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Ductwork</td>
<td>See Section 15890 for testing requirements</td>
<td></td>
</tr>
</tbody>
</table>

*The air test shall be made by attaching an air compressor testing apparatus to any suitable opening, and after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gage pressure.*
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.

END OF SECTION 01810
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, see drawings.

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
PART I - GENERAL

1.01 DESCRIPTION

A. Scope: The Work of this Section includes all material and installation of cast-in-place Concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes as shown and detailed on the Drawings and specified herein.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.03 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and
supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates
2. Form materials and form-release agents
3. Steel reinforcement and reinforcement accessories
4. Fiber reinforcement
5. Admixtures
6. Waterstops
7. Curing materials
8. Floor and slab treatments
9. Bonding agents
10. Adhesives
11. Vapor retarders
12. Epoxy joint filler
13. Joint-filler strips
14. Repair materials

1.04 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those
performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 01, "Specification for Structural Concrete."
2. ACI 17, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 302-2R-06, "Guide to Concrete Slabs that Receive Moisture Sensitive Flooring Materials.

G. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

1. Contractor's superintendent.
2. Independent testing agency responsible for concrete design mixes.
4. Concrete subcontractor.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

PART II - PRODUCTS
2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

   a. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities.
not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾" x ¾", minimum.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.


H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

   1. Furnish units that will leave no corrodible metal closer than 1” to the plane of the exposed concrete surface.

   2. Furnish ties that, when removed, will leave holes not larger than 1” in diameter in concrete surface.

   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast
concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 755M.

E. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.04 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Moderate weathering region, but not less than 3M.


C. Water: Potable and complying with ASTM C 94.

2.05 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other
admixtures and cementitious materials. Do not use admixtures containing calcium chloride. Use no mixtures not included in the mix design.

2.06 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat, dumbbell with center bulb.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat, dumbbell with center bulb.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

2.07 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 15 mils (0.25 mm) thick:
   1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 15 mils (0.25 mm) thick.
   2. Three-ply, nylon or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 15 mils (0.18 mm) thick.

B. Fine-Graded Granular Material: Clean mixture of crushed stone or crushed gravel; ASTM D 448, Size 10, with 100% passing a No. 4 sieve and 10 to 30% passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100% passing a 1-½” sieve and 0 to 5% passing a No. 8 sieve.

2.08 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery
aggregate containing not less than 50% aluminum oxide and not less than 25% ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

C. Penetrating Liquid Floor Treatment – Exterior: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

2.09 CURING MATERIALS – EXTERIOR CONCRETE

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

D. Curing compound and areas to receive compound must be approved by University's Representative prior to placement.

E. Curing Compounds containing Silicates are acceptable for bare or exterior concrete but not in areas to receive any type of flooring materials.

2.10 CURING MATERIALS – INTERIOR CONCRETE

A. No curing compound containing Silicates will be allowed on any interior project.

B. Known curing compounds not containing silicates are:

   a. Type I Class B. Wr Meadows Vocom 25

      i. Contains 25% acrylic

      ii. Must Comply with ASTM – F1315

2.11 RELATED MATERIALS


B. Epoxy Joint Filler: Two-component, semirigid, 100% solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

   1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
E. Reglets: Fabricate reglets of not less than 0.0217-inch-thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch-thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from $\frac{1}{8}$" and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, $\frac{1}{8}$ to $\frac{1}{4}$" or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.


1. Maximum Slump: 5" (125 mm).

D. Slab-on-Grade: Proportion normal-weight concrete mix Compressive Strength (28 Days): 3000 psi (20.7 MPa).

1. Maximum Slump: 5" (125 mm).


1. Maximum Slump: 5" (125 mm).

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90°F, reduce mixing and delivery time from 1-½ hours to 75 minutes; when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

PART III - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, \( \frac{1}{8} \)"
2. Class B, \( \frac{1}{4} \)"

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

F. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely
braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.

2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50ºF (10ºC) for 24 hours after placing concrete provided concrete is hard enough to
not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by University's Representative.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR RETARDERS

A. Fine-Graded Granular Material: Provide sand under vapor retarder, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus ¾” (19 mm).

B. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

C. Pour Concrete directly on Vapor Barrier.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop-or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by University’s Representative.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-⅜” into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of ⅛”. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut ⅛”-wide joints into concrete when cutting
action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than ½” or more than 1” below finished concrete surface where joint sealants are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer’s written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer’s written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.09 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by University’s Representative.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24” and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible
effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6” into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.


3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90°F at time of placement. Chilled mixing water or chopped ice may be used to control
temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding ⅛" in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

2. Do not apply rubbed finish to smooth-formed finish.
C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated on drawings and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 45; and levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and levelness, F(L) 24.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be
installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a medium broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with University's Representative before application.

G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.

2. After broadcasting and tamping, apply float finish.

3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTION AND CURING – EXTERIOR

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12” lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12” and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer’s written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer’s written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 CONCRETE PROTECTION AND CURING – INTERIOR

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during
finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12" lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12" and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas within three hours after initial application. Maintain continuity of coating and repair damage during curing period. **Curing Compound can not have any Silicates**

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating
and repair damage during curing period. **Curing and Sealing Compound can not have any Silicates**

### 3.15 JOINT FILLING

**A.** Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least two (2) months. Do not fill joints until construction traffic has permanently ceased.

**B.** Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

**C.** Install semi rigid epoxy joint filler full depth in saw-cut joints and at least 2” deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.16 CONCRETE SURFACE REPAIRS

**A.** Defective Concrete: Repair and patch defective areas when approved by University's Representative. Remove and replace concrete that cannot be repaired and patched to University's Representative's approval.

**B.** Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

**C.** Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½” in any dimension in solid concrete but not less than 1” in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by University's Representative.

**D.** Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch
wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

E. Perform structural repairs of concrete, subject to University's Representative's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to University's Representative's approval.

3.17 FIELD QUALITY CONTROL

A. University's Testing Agency: University will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each
composite sample, but not less than one test for each day's pour of each concrete mix.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
   a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
   a. Test two field-cured specimens at 7 days and two at 28 days.
   b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to University's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by University's Representative but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by University's Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by University's Representative.

END OF SECTION 03300
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: Unimast, Inc., Gold Bond Building Products Division of the National Gypsum Corp., or 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) #4943P.

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

   **18ga minimum typical framing (non-OSHPD projects) 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) 25ga electro-galvanized steel sheet, roll-formed, HAT: 2-¾" x ¾" deep with ½" wide flanges.

       b) Zee: 1-½" x 1-½".

       c) 25ga electro-galvanized sheet, roll-formed. Resilient RC channels.

   2. **Floor runners or C-Track:** 18ga minimum Un-punched track (for Non-OSHPD projects),

   3. **Top Runner or Slotted Track:** 18ga minimum deep leg punched track: SLP-TRK, or equal (for Non-OSHPD projects).

   4. **Stud Stiffeners:** ¾" cold rolled steel weighing not less than 300 lbs. per 1000 lineal feet; rust-inhibitive coated.

   5. **Channels:** 2-½" 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, 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; ¼” x ½”, 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:


2. Structural Studs: MLSFA (Metal Lath/Steel Framing Association).

B. Metal Stud Partitions:


2. Floor Runners: Secure with ⅜” 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 intermediate; 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 06200
FINISH CARPENTRY

PART I - GENERAL

1.01 DESCRIPTION
A. Scope: Work of this Section shall include all materials and installation necessary to provide Finish Carpentry, including window sills and other wood trims. As shown and detailed on the Drawings and specified herein.

1.02 RELATED WORK
A. Division 8 – WOOD DOORS
B. Division 9 – PAINTING

1.03 QUALITY ASSURANCE
A. Moisture content of lumber at the time of delivery to site shall not be more than 10%.
B. Fire Retardant Treatment: Comply with AWPA standards for pressure impregnation with fire-retardant chemicals to achieve flame-spread rating of not more than 25 in accordance with ASTM E84 or UL Test 723.
1. Treat interior wood and plywood.
2. Provide UL label on each piece of fire-retardant wood and plywood.
3. Kiln-dry treated items to maximum moisture content of 19%.
C. Mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish.
D. Finish carpentry shall conform to the requirements of the latest edition of "Manual of Millwork" of the Woodwork Institute of California (WIC).

1.04 SUBMITTALS
A. Shop Drawings: Submit drawings at half-full size scale minimum, showing materials, methods of fabrication and details of installation for all finish carpentry.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING
A. Protect lumber and finish carpentry from dampness both during and after delivery at site.
B. Do not store finish carpentry exposed to the weather. Do not install finish carpentry in any room or space where concrete, masonry, or plaster work is not complete and dry.

1.06 ENVIRONMENT REQUIREMENTS
A. Maintain Work areas and storage areas at a minimum temperature of 70°F for not less than 10 days before and during installation of interior finish carpentry.
PART II - PRODUCTS

2.01 MATERIALS

A. All finish carpentry shall comply with Custom Grade as defined by WIC, unless otherwise specified or shown on Drawings.

B. Each piece of lumber shall be surfaced four sides (S4S).

C. Lumber, Solid Stock:
   1. Paint Grade: Solid hardwood, Douglas Fir No. 1, 1500 F, clear heart.

D. Concealed Plywood: Any species containing no defects which materially affect strength or utility of piece. Front surfaces of back panels of casework shall be solid.

E. Fasteners: As shown, and in accordance with WIC Custom Grade Standards.

2.02 FABRICATION

A. Fabricate all items as shown; miter joints in conformance with WIC, Custom Grade requirements. Shop applied finishes for all items.

PART III - EXECUTION

3.01 INSPECTION

A. Verify that surfaces and spaces to receive finish carpentry are satisfactory for their installation. If unsatisfactory conditions exist, do not install until such conditions have been corrected.

3.02 INSTALLATION

A. Install the work straight, plumb, and level, with tight joints and no distortions. Shim as required using concealed shims. Maximum tolerance of ⅛” in 8’ for plumb with maximum offset in flush adjoining and ¼” maximum offsets in revealed adjoining surfaces. Scribe and cut work to fit adjoining work and refinish surfaces or repair damaged finish at cuts.

B. Provide all anchoring and fastening devices required for installation. Provide countersunk nails and fill nail holes.

3.03 ADJUSTMENT AND CLEANING

A. Repair or replace damaged and defective finish carpentry work to eliminate defects functionally and visually. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.

C. Protect finish carpentry against damage until the Work is accepted.

END OF SECTION 06200
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 Numbers & 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:
      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.

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, ⅞" wide x 11½" high, 2" adjustment. Model No. 87-187 standard with #187LL bracket and #211 shelf rest by Knape 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 ¾" 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 ¾" thick plywood core with 3" wide edge banding for a total edge thickness of 1-¼", except as otherwise shown on Drawings and specified herein; ¼" 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 ¾" with bonded lip, or ½" if supported per DuPont standards. Provide ¼" 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 ½” 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 ¾” 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 UCDMC 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 \(\frac{3}{16}”\).

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
PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work of this Section shall include all materials and installation necessary to provide Sheet Membrane Waterproofing as shown and detailed on the Drawings and specified herein, including:

2. Rubberized asphalt sheet membrane waterproofing system.
3. Liquid Membrane

B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Division 3 – CONCRETE
2. Division 7 – THERMAL and MOISTURE PROTECTION

1.02 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM)


1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all component of waterproofing system.

B. Samples: Submit representative samples of the following for approval:

1. Sheet membranes.
2. Protection Board.

C. Manufacturers Installation Instructions: Indicating special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has a least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

E. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on-site periodically during membrane waterproofing work to review installation procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets.
Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

2. Protect mastic and adhesive from moisture and potential sources of ignition.

3. Store protection board flat and off the ground. Provide cover on top and all sides.

4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.07 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 10 year material warranty issued by the membrane manufacturer upon completion of work.

PART II - PRODUCTS

2.01 MATERIALS

A. Preapplied Sheet Waterproofing Membrane: Bituthene® Preprufe™ 160.

1. Waterproofing Membrane by Grace Construction Products, a three-layer composite sheet membrane consisting of 0.41 mm (0.016") of high-density
polyethylene film, 0.64 mm (0.025") of specially formulated synthetic adhesive and 0.03 mm (0.001 in.) of protective coating.

2. Preapplied Sheet Waterproofing Membrane.

PHYSICAL PROPERTIES FOR BITUTHENE PREPRUFE 160 MEMBRANE:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Black with white protective coating</td>
</tr>
<tr>
<td>Thickness Method A</td>
<td>ASTM D 3767</td>
<td>1.07 mm (0.042&quot;) nominal</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>ASTM D 1970</td>
<td>Unaffected at -23°C (-10°F)</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D 412</td>
<td>300% minimum</td>
</tr>
<tr>
<td>Crack Cycling</td>
<td>ASTM C 836</td>
<td>Unaffected at -23°C (-10°F), 100 Cycles</td>
</tr>
<tr>
<td>Tensile Strength, Film</td>
<td>ASTM D 412</td>
<td>27 600 kPa (4,000 lb/in².) minimum</td>
</tr>
<tr>
<td>Peel Adhesion to Concrete</td>
<td>ASTM D 903</td>
<td>880 N/m (5.0 lb/in.) minimum</td>
</tr>
<tr>
<td>Modified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lap Adhesion</td>
<td>ASTM D 1876</td>
<td>440 N/m (2.5 lb/in.) modified minimum</td>
</tr>
<tr>
<td>Resistance to Hydrostatic Head Modified</td>
<td>ASTM D 5385</td>
<td>70 m (231 ft.) minimum</td>
</tr>
<tr>
<td>Permanence Method B</td>
<td>ASTM E 96</td>
<td>0.6 ng/m²sPa (0.01 perms)</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>0.5% maximum</td>
</tr>
</tbody>
</table>

B. Preapplied sheet Waterproofing Membrane: Bituthene® Preprufe™ 300

1. Waterproofing Membrane by Grace Construction Products, a four-layer composite sheet membrane consisting of 0.8 mm (0.030") of high-density polyethylene film,
0.6 mm (0.025”) of specially formulated synthetic adhesive and 0.03 mm (0.001”) of protective coating and surface treatment.

2. Preapplied Sheet Waterproofing Membrane

PHYSICAL PROPERTIES FOR BITUTHENE PREPRUFE 300 MEMBRANE:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Black with white</td>
</tr>
<tr>
<td>Protective coating and white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>ASTM D 3767</td>
<td>1.42 mm (0.056”)</td>
</tr>
<tr>
<td>Method A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Temperature</td>
<td>ASTM D 1970</td>
<td>Unaffected at -23°C (-10°F)</td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D 412</td>
<td>300% minimum</td>
</tr>
<tr>
<td>Crack Cycling</td>
<td>ASTM C 836</td>
<td>Unaffected at -23°C (-10°F), 100 Cycles</td>
</tr>
<tr>
<td>Tensile Strength, Film</td>
<td>ASTM D412</td>
<td>27 600 kPa (4,000 lb/in.²) minimum</td>
</tr>
<tr>
<td>Puncture Resistance</td>
<td>ASTM E154</td>
<td>800 N (180 lb) minimum</td>
</tr>
<tr>
<td>Peel Adhesion to Concrete</td>
<td>ASTM D 903</td>
<td>880 N/m (5.0 lb/in.) minimum</td>
</tr>
<tr>
<td>Lap Adhesion Modified</td>
<td>ASTM D 1876</td>
<td>440 N/m(2.5 lb/in.) minimum</td>
</tr>
<tr>
<td>Resistance to Hydrostatic Head</td>
<td>ASTM D 5385</td>
<td>70m (231 ft.) minimum</td>
</tr>
<tr>
<td>Permanence</td>
<td>ASTM E 96</td>
<td>0.6 ng/m²sPa (0.01 perms)</td>
</tr>
<tr>
<td>Method B</td>
<td>maximum</td>
<td></td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>0.5% maximum</td>
</tr>
</tbody>
</table>

C. Sheet Membrane Waterproofing System: Bituthene® System 4000 by Grace Construction Products:

1. A self-adhesive, cold-applied Composite sheet consisting of a thickness of 1.4 mm (0.056”) of rubberized asphalt and 0.1 mm (0.004”) of cross-laminated, high-density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet.
which is removed during installation. No special adhesive or heat shall be required to form laps.

2. Sheet Membrane Waterproofing.

3. Protection Board:

a. Drainage Composition: Hydroiduct 2 by Grace Construction Products. Use Drainage Board over Bituthene 4000 in our vertical applications. Drainage composite to meet the following criteria:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAINAGE CORE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer</td>
<td>ASTM C 366</td>
<td>High Impact Polystyrene</td>
</tr>
<tr>
<td>Thickness</td>
<td>Method B</td>
<td>9.5 mm (0.375”) nominal</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM D 1621</td>
<td>718 kPa (15,000 lb/ft²)</td>
</tr>
<tr>
<td>Flow Rate (gradient 0.1,37.9 kPa)</td>
<td>ASTM D 4716</td>
<td>0.003 m²/s (15 gal/min./ft)</td>
</tr>
<tr>
<td>GEOTEXTILE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Nonwoven</td>
<td></td>
</tr>
<tr>
<td>Polymer</td>
<td>Polypropylene</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>ASTM D 3776</td>
<td>136 g/m² (4.0 oz/yd²)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 4632</td>
<td>445 N (100 lb)</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM D 4533</td>
<td>222 N (50 lb)</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>ASTM D 4751</td>
<td>0.150-0.212 mm (70-100 U.S. sieve)</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D 4491</td>
<td>6095 L/min./m² (150 gal/min./ft²)</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM D 3786</td>
<td>1860 kPa (270 lb/in.²)</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D 4833</td>
<td>35 kg (75 lb)</td>
</tr>
</tbody>
</table>

b. Asphaltic Hardboard: Bituthene Asphaltic Hardboard by Grace Construction Products; a premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3 mm (0.125”) thick hardboard on horizontal surfaces not receiving steel reinforced slab. Where steel reinforcing bars are to be used, apply two layers of 3 mm
(0.125") thick hardboard. Use Hardboard over Bituthene 4000 at horizontal applications.

4. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

**PHYSICAL PROPERTIES FOR BITUTHENE SYSTEM 4000:**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Dark gray-black</td>
</tr>
<tr>
<td>Thickness Method A</td>
<td>ASTM D 3767</td>
<td>1.5 mm (0.060&quot;) nominal</td>
</tr>
<tr>
<td>Flexibility, 180° Bend over 25 mm (1 in.) Mandrel at -43°C (-45°F)</td>
<td>ASTM D 1970</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Tensile Strength, Membrane Die Modified</td>
<td>ASTM D412</td>
<td>2240 KN/m² (325 lb/in²) minimum</td>
</tr>
<tr>
<td>Tensile Strength Film</td>
<td>ASTM D882</td>
<td>34 500 KN/m² (5000 lb/in²) minimum</td>
</tr>
<tr>
<td>Elongation Ultimate Failure of Rubberized Asphalt</td>
<td>ASTM D 412</td>
<td>300% minimum</td>
</tr>
<tr>
<td>Cycling Over 6 mm (0.25 in.) Crack at -32°C (-25°F), 100 Cycles</td>
<td>ASTM C 836</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Lap Adhesion at Minimum Application Temperature</td>
<td>ASTM D 1876</td>
<td>880 N/m (5.0 lb/in.)</td>
</tr>
<tr>
<td>Peel Strength</td>
<td>ASTM 903</td>
<td>1576 N/m (9 lb/in.)</td>
</tr>
<tr>
<td>Puncture Resistance Membrane</td>
<td>ASTM E 154</td>
<td>222 N/m (50 lb) minimum</td>
</tr>
<tr>
<td>Resistance to Hydrostatic Head</td>
<td>ASTM D 5385</td>
<td>70 m (231 ft.) of water</td>
</tr>
<tr>
<td>Exposure to Fungi in Soil, 16 Weeks</td>
<td>GSA-PBS 07115</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Permanence Method B</td>
<td>ASTM E 96</td>
<td>2.9 ng/m²sPa (0.05 perms)</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>0.1% maximum</td>
</tr>
</tbody>
</table>
D. Sheet Membrane Waterproofing: Bituthene® 5000 by Grace Construction Products.

1. A self-adhesive, cold-applied composite sheet consisting of a total thickness of 1.6 mm (0.065"). It is composed of 1.4 mm (0.056”) of rubberized asphalt and a layer of high-strength, heat resistant woven polypropylene mesh. Provide rubberized
asphalt membrane covered with a sheet which is removed during installation. No special adhesive or heat shall be required to form laps.

PHYSICAL PROPERTIES FOR BITUTHENE 5000:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>ASTM D 3767</td>
<td>1.77 mm (0.065&quot;) nominal</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 882</td>
<td>345 kN/m² (50 lb/in²)</td>
</tr>
<tr>
<td>Elongation, Mesh</td>
<td>ASTM D 882</td>
<td>25% minimum</td>
</tr>
<tr>
<td>Puncture Resistance, Mesh</td>
<td>ASTM E 154</td>
<td>890 N (200 lbs)</td>
</tr>
<tr>
<td>Flexibility, 180° bend over 0.25&quot; mandrel at -4°C (25°F)</td>
<td>ASTM D 1970</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Crack Cycling at -4°C (25°F), 100 cycles</td>
<td>ASTM C 836</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Permanence</td>
<td>ASTM E 96</td>
<td>58 ng/m³sPa (1.0 perms)</td>
</tr>
<tr>
<td>Peel Adhesion</td>
<td>ASTM D 903</td>
<td>880 N/m (5 lbs/in.)</td>
</tr>
</tbody>
</table>

E. Bituthene Liquid Membrane

1. A two component, elastomeric, cold applied, trowel grade material. Physical properties for Bituthene Liquid Membrane:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Component A: Black</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Component B: Clear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Component Mixture: Black</td>
</tr>
<tr>
<td>Solids Content</td>
<td>ASTM D 1644</td>
<td>100%</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D 412</td>
<td>250% minimum</td>
</tr>
<tr>
<td>Peel Strength minimum</td>
<td>ASTM D 903</td>
<td>880 N/m (5 lb/in.)</td>
</tr>
<tr>
<td>Flexibility, 180° bend over 25 mm (1&quot;) mandrel at -32°C (-25°F)</td>
<td>ASTM D 1970</td>
<td>Unaffected</td>
</tr>
</tbody>
</table>
2. Use fillet material at inside corners, sealing material at terminations and repair material for defects on concrete surfaces.

F. Drainage Composite: Hydroduct 2® Drainage Composite

1. Consists of a nominal 10mm (0.375") thick drainage core, a high performance geotextile and a high strength backing film Compressive strength 718 kPa (15,000 lb/ft²), drainage flow rate .003 m²/s (15 gal/min/ft²).

PHYSICAL PROPERTIES FOR HYDRODUCT 2 DRAINAGE COMPOSITE

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAINAGE: CORE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer</td>
<td>ASTM C366</td>
<td>High Impact Polystyrene</td>
</tr>
<tr>
<td>Thickness</td>
<td>Method B</td>
<td>9.5mm (0.375&quot;) nominal</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM D 1621</td>
<td>718 kPa (15,000 lb/ft²)</td>
</tr>
<tr>
<td>Flow Rate (gradient 0.1, 37.9kPa)</td>
<td>ASTM D 4716</td>
<td>0.003 m²/s (15 gal/min/ft)</td>
</tr>
<tr>
<td>GEOTEXTILE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Nonwoven</td>
<td></td>
</tr>
<tr>
<td>Polymer</td>
<td>Polypropylene</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>ASTM D 3776</td>
<td>136 g/m² (4.0 oz/yd²)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 4632</td>
<td>455 N (100 lb)</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM D 4533</td>
<td>222 N (50 lb)</td>
</tr>
<tr>
<td>Apparent Opening size</td>
<td>ASTM D 4751</td>
<td>0.150-0.212mm</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D 4491</td>
<td>6095 L/min/m² (150 gal/min/ft²)</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM D 3786</td>
<td>1860 kPa (270 lb/in²)</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D 4833</td>
<td>35 kg (75 lb)</td>
</tr>
</tbody>
</table>

G. Miscellaneous Materials: Primer, mastic, and accessories specified or adaptable to manufacturer of sheet membrane waterproofing.

PART III - EXECUTION

3.01 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental
to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION OF SUBSTRATES

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

B. Cast-In-place Concrete Substrates:

1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).

2. Fill form tie rod holes with concrete and finish flush with surrounding surface.

3. Repair bugholes over 13 mm (0.5”) in length and 6 mm (.25”) deep and finish flush with surrounding surface.

4. Remove scaling to sound, unaffected concrete and repair exposed area.

5. Grind irregular construction joints to suitable flush surface.

C. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.03 INSTALLATION OF 160 MEMBRANE AND 300 MEMBRANES

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to the following:

1. Apply membrane with the HDPE film facing the existing conditions. Remove the release liner and fasten membrane to existing condition. Hydrostatic applications, apply membrane over substrate.

2. Apply succeeding sheets by overlapping the previous sheet 75 mm (3") along the uncoated edge of the membrane.

3. Overlap the ends of the membrane 75 mm (3"). Apply Bituthene® Preprufe™ Tape centered over the end lap and roll firmly. Remove release liner.

3.04 INSTALLATION OF 4000 MEMBRANE AND 5000 MEMBRANE

A. Refer to manufacturer's literature for complete installation instructions, but not limited to the following:

1. Apply surface conditioner treatment at dilution and rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and
protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner/primer.

2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.

3. Seal daily terminations with troweled bead of mastic.

4. Apply protection board and related materials in accordance with manufacturer's recommendations.

5. The asphalt concrete pavement shall be placed as soon as possible after the installation of the Bituthene 5000 membrane. A minimum of 50 mm (2") compacted overlay is recommended. The temperature of the asphalt concrete shall be a minimum of 120°C (250°F) at time of compaction.

3.05 INSTALLATION OF BITUTHENE LIQUID MEMBRANE

A. All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants.

B. Bituthene liquid membrane may be applied at temperatures of -40°C (-25°F) or above.

C. Bituthene Liquid Membrane must be applied at a minimum thickness of 2.3 mm (0.090").

D. In fillet applications the face of fillet should be a minimum of 20 mm (0.75")

3.06 INSTALLATION OF HYDRODUCT 2 DRAINAGE COMPOSITE

A. In vertical applications, Hydroduct 2 Drainage Composite can be applied to the substrate vertically or horizontally but, in either case, should extend from the perimeter discharge pipe to a point approximately 150 mm (6") below the anticipated grade line.

B. When Adhering Hydroduct 2 Drainage Composite directly to Bituthene waterproofing membranes, Bitustik Tape should be used. When using Bitustik Tape, press firmly to ensure good adhesion. Substrate and job site conditions will determine the attachment pattern. Abut adjacent rolls with excess fabric overlapping in shingle fashion.

C. For inside and outside corners, abut adjoining drainage composite at the corner. Cover open core with extra geotextile filter fabric.

D. The exposed core along the top terminations should be covered with a strip of geotextile to prevent intrusion of soil into core. At the bottom termination extend the Hydroduct 2 Drainage Composite out from the structure so that it passes behind and under the perimeter discharge pipe. Additional geotextile should be wrapped over the pipe to prevent soil intrusion.

E. To secure Hydroduct 2 Drainage Composite around protrusions, apply Bitustik Tape around the protrusion in a picture frame configuration. Cut Hydroduct 2 Composite to fit snugly around the protrusion. Press the cut edge firmly into the Bitustik Tape.

F. Hydroduct 2 Drainage Composite should be covered promptly. Do not leave Hydroduct 2 Drainage Composite exposed to sunlight for more than two weeks. Motor vehicles,
construction equipment or other trades should not be allowed directly on the Hydroduct 2 Drainage Composite.

3.07 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION 07110
SECTION 07210
BUILDING INSULATION

PART I - GENERAL

1.01 DESCRIPTION:
   A. Scope: Work under this Section includes all materials and installation necessary to provide Building Insulation, as shown and detailed on the drawings and specified herein.
   B. Related Work Specified Elsewhere:
      1. Insulation of pipes and ducts: Division 15 – MECHANICAL.

1.02 REFERENCE STANDARDS

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.
   D. Certificates: Submit manufacturer's certification that insulating materials comply with California Quality Standards for insulating materials; CBC, Section 807.

1.04 PRODUCT HANDLING
   A. General: Refer to Section 01310 – COORDINATION.

1.05 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. Manufacture:
      1. Specified products are manufactured by the Owens/Corning Fiberglas Corp., unless otherwise indicated.
      2. Manville Building Products or equal.
      3. Thickness: As shown; where not shown, as required to meet CBC ratings.
B. Batt Insulation: Unfaced; ASTM C665 Type I.

C. Sound Insulation:
   1. General: Sound Attenuation Batt Insulation; ASTM C665, Type 1, and ASTM E136.

D. Vapor Barrier Membrane: 6 mil plastic sheet; FS L-P-375.

E. Fasteners:
   1. Mechanical:
      a. General: As recommended by manufacturer, for application as shown.
      b. Staples: 7/64" wire staples.
      d. Impaling Spindles: Manufacturer's standard pin spindles, with washers; fastener size as recommended by manufacturer for thickness if insulation.
   2. Wire:
      a. General: 16 or 18 gage steel.
      b. Supports:
         1) Manufactured by Tiger Teeth, Inc.
         2) Or equal.
   3. Adhesive: As recommended by manufacturer.
   4. Tape: As recommended by manufacturer, for application shown.

F. Caulking: Per Section 07920 – CAULKING AND SEALANTS.

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 at exterior walls; ceilings below roof areas, where shown; and other locations, including above suspended ceilings, in strict conformance with referenced
standards, the manufacturer's written directions, and as shown. Install wall and ceiling insulation to create complete thermal enclosure around habitable space.

B. Batt Insulation:

1. Ceilings:
   a. General: Install with friction fit at sides and firmly butted ends without gaps or voids.
   b. Joists:
      1) General: Staple to joists at 4” on center; minimize air leaks.
      2) Wire-up Fastening System: Wire and supports as recommended by manufacturer.
   c. Suspended Ceilings: Place in truss spaces above suspended ceiling materials, fit snugly between ceiling supports and at edges and ends to minimize air leaks; extend 12” beyond wall lines.

2. Stud Walls: Install with friction fit at sides and firmly butted ends without gaps or voids; attach faced insulation to studs at 4” on center; minimize air leaks.

C. Sound Insulation: Friction fit to cavity where shown at interior walls.

D. Vapor Barrier Membrane: Staple to exterior framing; lap sheets 4” minimum; seal membrane at door and window openings with caulking as specified under Section 07920 – CAULKING AND SEALANTS.

3.03 CLEANING

A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove all surplus materials, rubbish, and debris.

END OF SECTION 07210
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 grains h⁻¹ ft⁻² 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 grains h⁻¹ ft⁻² in. Hg⁻¹
   2. ASTM D 7234 Test Method for Pull-Off Adhesion Strength of Coatings on concrete using portable Pull-Off Adhesion Testers
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
PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work of this Section shall include all materials and installation necessary to provide Single-Ply Roofing as shown and detailed on the Drawings and specified herein, including:

1. Felt back PVC single-ply membrane over an existing built-up roof/mineral cap sheet.
2. PVC single-ply membrane over existing poly-iso board insulation, over existing built-up roof with granule surface spud off.
3. PVC single-ply membrane over existing poly-iso board insulation over existing concrete deck.

B. Related Work: The work includes but is not necessarily limited to the installation of:

1. Fasteners
2. Roof Membrane
3. Roof Membrane Flashings
4. Metal Flashings
5. Sealants and Adhesives

1.02 QUALITY ASSURANCE

A. This roofing system shall be applied only by a Contractor authorized by the respective PVC single-ply manufacturer prior to bid.

B. Contractor shall provide as follows: Upon completion of the installation, and the delivery to the PVC single-ply manufacturer by the Contractor of a certification that all work has been done in strict accordance with the contract specifications and manufacturers' requirements, an inspection shall be made by a representative of the manufacturer to observe the roofing system.

C. All work shall be completed by personnel trained and authorized by the PVC single-ply manufacturer.

D. All work must be inspected by UCD Fire Department.

1.03 CODE REQUIREMENTS

A. The roofing Contractor shall submit evidence that the proposed roofing system will meet the identified requirements of the following recognized code approval or testing agencies. These requirements are minimum standards and no roofing work shall commence without
written documentation of the system’s compliance, as required in the “Submittals” section of this specification.

1. Factory Mutual Research Laboratories, Norwood, Massachusetts.
   a. F. M. Class I system acceptance.
   b. F. M. I-90 wind uplift resistance.

2. Underwriters Laboratories, Chicago, IL.
   a. U. L. Class A membrane.

3. All work to comply with Title 24.

1.04 SUBMITTALS

   A. After the notice to proceed the roofing Contractor shall submit to the University’s Representative the following:


   2. Samples of each material to be used in the roof system including each component of manufacturer’s literature.

   3. Specimen copy of warranty – material and labor and Contractor's warranty per Division 1.

   4. Dimensional shop drawings which shall include:
      a. Outline of roof and roof size.
      b. Profile details of flashing methods for penetrations and terminations.
      c. Technical acceptance from PVC manufacturer.

   5. Written approval from the PVC manufacturer for this application on system specified.

   6. Letter from PVC manufacturer stating Contractor is an approved applicator.

   7. MSDS sheets for all adhesives are to be submitted to UCD Fire Department for review.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

   A. All products delivered to the job site shall be in the original unopened containers or wrapping

   B. Handle all materials to prevent damage. Place all materials on pallets and fully protected from moisture.

   C. Membrane roofs shall be stored lying down on pallets, and fully protected from moisture with clean canvas tarpaulins.
D. Bonding adhesives shall be stored at temperatures above 40ºF.

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on container or supplied by material manufacturer/supplier. The proposed storage site for flammable solvents must be off-site or a minimum of 20’ from the Hospital. The site must be approved by UCD Fire Department prior to delivery.

F. All materials which are determined damaged by the University's Representative are to be removed from the job site and replaced at no cost to the University.

1.06 PROJECT CONDITIONS

A. PVC single-ply materials may be installed under the following weather conditions (extreme temperatures, moisture, humidity), but only after consultation with PVC manufacturer and University's Representative, as performance of PVC single-ply materials, as well as installation costs and production may be affected.

B. Only as much of the new roofing as can be made weather tight each day, including all flashings, and metal work shall be installed.

C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

D. All surfaces to receive new insulation, membrane or flashings shall be thoroughly dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry the surface prior to application.

E. All new temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or damage.

F. Temporary waterstops shall be installed at the end of each day's work, and shall be removed before proceeding with day's work. Waterstops shall be compatible with all materials and shall not emit dangerous or incompatible fumes.

G. The Contractor is cautioned that certain PVC single-ply membranes are incompatible with asphalt, coal tar and oil based materials and cements. Creosote and penta-based materials are also incompatible. Such materials should not come in contact with PVC membranes at any time. If such contacts occur, the material shall be cut out and discarded. The Contractor should consult PVC manufacturer with respect to material compatibility, precautions, and recommendations.

H. Arrange work sequence to avoid use of newly-constructed roofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. Both polywood and polyester felt protection
shall be provided for all new and existing roof areas which receive traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. All roofing, insulation, flashings and metal work removed for construction shall be immediately taken off the site to a legal dumping area authorized to receive such materials,

K. The Contractor shall follow all safety regulations as recommended by OSHA.

L. The Contractor should take care during application and storage that overloading of deck and structure does not occur.

M. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.

N. Contaminants, such as grease, fats, oils, and solvents, shall not be allowed to come into contact with the PVC single-ply roofing membrane except as noted and at specified area
and only as delineated within the contract documents. Any other such contact shall be reported to the University's Representative.

O. Contractor shall verify that all roof drain lines are unblocked before starting work. Report any such blockages to the University's Representative in writing.

P. If any unusual or concealed condition is discovered, stop work and notify University's Representative immediately in writing.

Q. Site clean-up, including both interior and exterior building areas which have been affected by construction, shall be completed to the University's satisfaction.

R. All landscaped areas affected by construction activities shall be returned to their pre-construction state.

S. The degree to which the roof deck allows air infiltration into the roof assembly may add to the uplift forces on the roof system:

1. If any wall openings greater that 10% of the wall surface, contact PVC manufacturer for recommendations.

2. The effects of positive pressure inside the building must be considered. For conditions of positive pressure greater than .5" of water inside the building, contact PVC manufacturer for recommendations.

T. No work is to proceed until a formal Interim Life Safety Measure, approved by UCD Fire Department is in place.

U. No fumes from the adhesives are to be drawn into the Hospital HVAC system.

1.07 WARRANTY

A. Furnish to University a written guarantee for the single-ply roofing system from the single-ply manufacturer against all defects in materials and workmanship, for 10 years from date of acceptance.

B. Furnish to University a written guarantee for the single-ply roofing system from the Contractor against all defects in workmanship, including without limitation to roofing, flashings, or metal work, for 3 years from date of acceptance.

PART II - PRODUCTS

2.01 GENERAL

A. Components of the PVC single-ply fully adhered roof system are to be products on one PVC single-ply manufacturer.

2.02 APPROVED MEMBRANE SYSTEMS

A. Sarnafil G410L/Felt, manufactured by Sarnafil Inc., 48 mils nominal (.048") thickness, polyester reinforced membrane with an acrylic coating to repel dirt, and with a polyester 18 oz. felt laminated to the back. Exposed color of PVC membrane shall be gray.
B. Sarnafil G410L, manufactured by Sarnafil Inc., 48 mils nominal (.048") thickness, polyester reinforced membrane with an acrylic coating to repel dirt. Exposed color of PVC membrane shall be gray.

C. Trocal SR-60/Felt, manufactured by Trocal Inc., 50 mils nominal (.050") thickness, polyester reinforced membrane with an acrylic coating to repel dirt, and with a polyester 18 oz. felt laminated to the back. Exposed color of PVC membrane shall be gray.

D. Trocal SR-60, manufactured by Trocal Inc., 50 mils nominal (.050") thickness, polyester reinforced membrane with an acrylic coating to repel dirt. Exposed color of PVC membrane shall be gray.

E. Or equal, See Section 01630 Product Options and Substitutions for procedures to request substitution.

2.03 MEMBRANE

A. Membrane shall conform to ASTM D4434 (LATEST REVISION) Standard for poly (vinyl chloride) sheet roofing. Classification: Type II, Grade I, Color shall be gray.

B. Contractor must provide evidence that Manufacturer has comparable successful systems in place equal to that specified for a minimum of 5 years.

2.04 ACCESSORY PRODUCTS

A. Contractor shall obtain from the PVC single-ply manufacturer the following products:

B. Flashing Membrane: Flashing Membrane shall be as supplied by PVC single-ply manufacturer. Flashing membranes shall be the same material as provided for the roofing membrane without the felt back.

C. Flashing Membrane Adhesive: Adhesive for bonding the flashing membrane to substrates shall be a contact adhesive supplied by the PVC single-ply manufacturer.

D. Clad Metal: .020" thick membrane laminated to 25 gauge galvanized sheet metal.

E. Felt: Non-asphaltic polyester felt used as an asphalt barrier, leveling layer and slip sheet.

F. Welder: Automatic hot air welding apparatus for seaming of sheets.

G. Solvent Cleaner: Solvent Cleaner for removal of contaminates (adhesives) from the single-ply membrane.

H. Flatbar/turnbar: 14 gauge galvanized steel bar, channel shaped, punched 1” on center.

2.05 RELATED MATERIALS

A. Insulation: where specified or required, insulation shall be installed to form crickets.

1. Insulation for use in a fully adhered PVC membrane system shall be a Factory Mutual Class I fire rated, I-90 uplift approved board.

2. Insulation shall meet all identified code requirements.
3. Insulation shall be approved in writing by insulation manufacturer for intended use, and for use with PVC membrane materials.

4. Insulation shall be compatible with PVC membrane.

B. The following list of insulation boards are acceptable or equal:

1. Isocyanurate Insulations:
   a. SarnaTherm II isocyanurate insulation as supplied by Sarnafil, Inc.
   b. SaraTherm I isocyanurate insulation as supplied by Sarnafil, Inc.
   c. Energy I isocyanurate as manufactured by NRG Barriers, Inc.
   d. Isodeck GF isocyanurate as manufactured by Carpenter.
   e. Multi-max isocyanurate as manufactured by R-Max, Inc.
   f. Apache Pyrox isocyanurate as manufactured by Apache Building Products.

2. Insulation thickness shall be 1" or as required to form crickets identified in the specifications and construction documents.

C. Wood Nailers: Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on the project.
drawings. Height of the nailers shall be matched to that of the insulation thickness being used.

1. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated), #2 or better lumber. Creosote or asphaltic-treated lumber is not acceptable.

2. Wood nailers shall conform to Factory Mutual's Loss Prevention Data 1-49.

3. All wood shall have a maximum moisture content of 19% by weight on a dry weight basis.

2.06 ACCEPTED FASTENERS FOR ATTACHMENT OF INSULATION

A. The following fastener is approved for steel deck construction:

1. SFS Isofast IF2 Fasteners with 3" round galvanized plates.

B. Fastener Manufacturer's Warranty:

1. Fasteners and plates shall be Factory Mutual approved and meet F. M. Standard 4470 for corrosion resistance.

2. Fastener manufacturer shall warranty the performance of the fastener and plates for the duration of the warranty.

3. Fastener and plates shall be approved in writing by fastener manufacturer for intended use, and for use with manufacturer's products.

2.07 SEALANTS

A. The following caulking/sealants are accepted based on chemical compatibility with PVC single-ply membranes: TREMCO, Monolastomeric, one-part acrylic, Dow Corning/General Electric Co., Silpruf, one-part silicone sealant, Gates Engineering Co., GACO AS-3 one-part acrylic, or equal.

2.08 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners shall be of the same type as metal being secured. In general, all fasteners, anchors, nails, straps, shall be of zinc or cadmium plated steel, galvanized, or stainless steel. All fasteners and anchors shall have a minimum embedment of 1-¼” and shall be approved for such use by the fastener manufacturer. Fasteners for attachment of metal to wood blocking shall be annular ring nails. Fasteners for attachment of metal to masonry shall be expansion type fasteners. All fasteners shall meet Factory Mutual Standard 4470 for corrosion resistance.

PART III - EXECUTION

3.01 GENERAL

A. The Contractor shall coordinate the installation so that each area is made watertight at the end of each work period.
3.02 DECK PREPARATION

A. Preparation of Existing Roof shall be as follows:

1. On smooth surfaced roofs, the surface shall be clean and dry. All blisters shall be cut, laid back and sealed with an approved sealant.

2. On granule roof surfaces, gravel shall be spud off, sweep clean, all blisters shall be cut, laid back and sealed with approved sealant.

3. On foam roofs, remove all roofing, clean down to concrete deck and prepare substrate for insulation board installation.

3.03 SUBSTRATE PREPARATION

A. A proper substrate shall be provided to receive the PVC single-ply fully adhered membrane system.

B. The roofing Contractor shall inspect the roofing surface for defects such as excessive surface roughness, contaminated surfaces, structurally unsound substrates, etc., that will adversely affect the quality of work and prep areas as required to receive membrane/felt back system.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

3.04 INSTALLATION OF PVC SINGLE-PLY MEMBRANE

A. General

1. Over the properly prepared substrate surface, manufacturer approved contact adhesive shall be applied using recommended solvent resistant ¾” nap paint rollers, the adhesive shall be applied at a rate of approximately ¾ to 1-¾ gallons per 100 square feet depending on the substrate being adhered to. The Contractor shall use the rate specified by the manufacturer. The adhesive shall be applied in a smooth, even coating with no holidays, globs, puddles, or similar irregularities. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The adhesive shall be allowed to dry completely prior to installing the membrane.

2. When the adhesive on the substrate is dry, a second coat of adhesive will be applied, the 18 oz. felt back or membrane will be rolled into the fresh adhesive.
Immediately after placing the membrane, the entire surface area must be rolled with a foam covered water-filled lawn roller.

3. No bonding adhesive shall be applied in lap areas. All sheets shall be applied in the same manner, lapping all sheets as required by hot air welding techniques.

B. FM-90 System Perimeter and Corners
1. Over the properly installed and prepared substrate surface, PVC single-ply membrane half sheets are to be installed around the entire perimeter edge, per manufacturers' recommendations.

3.05 HOT AIR WELDING OF LAP AREAS

A. General:
1. Adjacent sheets shall be welded in accordance with PVC single-ply manufacturers’ written instruction. All side and end lap joints shall be hot-air welded. Lap areas shall be a minimum of 3” wide when machine welding, and a minimum of 4” wide when hand welding.

2. Welding equipment shall be obtained from or approved by PVC manufacturer. All mechanics intending to use the equipment shall have successfully completed a course of instruction provided by PVC manufacturer's representative prior to welding.

3. All surfaces to be welded shall be clean according to PVC manufacturer recommendations, and dry. No adhesive shall be present within the lap areas.

B. Hand Welding: Hand welded seams shall be completed in three stages. Equipment shall be allowed to warm up for at least one minute prior to start of welding.

1. The lap shall be tack welded every 3 feet to hold the seam in place.

2. The back edge of the lap shall be welded with a thin, continuous weld to prevent loss of hot air during the final welding.

3. The hot air nozzle, shall be inserted into the lap at a 45º angle. Once the proper welding temperature has been reached and the material starts to flow, the hand roller shall be applied at a right angle to the welding gun and pressed lightly. For straight laps, the 1-½” wide nozzle shall be used. For corners and compound connections, the ¾” wide nozzle shall be used.

C. Machine Welding: Machine welded seams may be achieved by the use of PVC manufacturers’ various automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. The automatic welding machines require 218 to 230 volts at 3040 amps. The use of a portable generator is recommended.

D. Quality Control of Welded Seams: all completed welded seams shall be checked by the Contractor after cooling for continuity using a rounded screwdriver or other suitable blunt object. Visible evidence that welding is proceeding acceptably is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of black material from the edge of completed joints. On-site evaluation of welded seams shall be made daily by the University's Representative or Manufacturer's
Representative. Two-inch wide cross-section samples shall be taken three times a day minimum through completed seams. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each testy cut shall be patched by the Contractor at no extra charge to the University.
3.06 INSULATION INSTALLATION

A. General Criteria:

1. Install Insulation in accordance with manufacturer's instructions.

2. Insulation shall be neatly cut to fit around penetrations and projections.

3. Fully adhere insulation to form crickets where stipulated with contact adhesive. PVC single-ply membrane to be fully adhered to insulation.

4. Install Tapered Insulation around drains creating a drain sump.

5. Do not install more Insulation than can be covered with membrane by the end of the day, or onset of inclement weather.

6. Mechanical Attachment.

   a. FM I-90 Approved Perimeter Fastening Pattern-Insulation panels which fall in the perimeter and corner areas of the building shall be fastened at a minimum rate of six fasteners for every 4’ x 8’ insulation panel, or according to the insulation manufacturer's requirements, whichever is more stringent. The perimeter area shall be defined as the strip of the roof around the outside perimeter of the building having a width defined by the least of the following parameters: 1) 10% of the building length; 2) 10% of the building width; 3) 40% of the building height. In any case, the perimeter width shall not be less than 4’.

   b. Fasteners are to be installed in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into
structural deck recommended by fastener manufacturer and PVC manufacturer.

c. Use fastener tools with a depth location as recommended or supplied by fastener manufacturer to ensure proper installation.

d. Provide pullout tests to verify deck condition and actual pullout values. Provide data to Architect and University's Representative.

B. Re-Roofing with Removal of Existing Roofing

1. Normal Humidity - Single Layer of Insulation without Vapor Retarder: one layer of insulation shall be mechanically fastened to the deck with accepted fasteners and plates. The insulation shall be laid in parallel courses with end joints staggered.

C. Fully adhere insulation to form crickets where stipulated with contact adhesive. PVC single-ply membrane to be fully adhered to insulation. Contractor may form crickets with treated plywood as an alternative and then fully adhere membrane over.

3.07 WOOD NAILERS INSTALLATION

A. Install continuous treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as specified on the project drawings.

B. Nailers shall be anchored to resist a minimum force of 175 pounds per linear foot in any direction. A ½” space shall be provided between nailer lengths. Individual nailer lengths shall not be less than 3’ long. Fasteners spacing shall be a maximum of 3’ on center. Fasteners shall be installed within 6” of each end. Spacing and fastener embedment shall conform to Factory Mutual Loss Prevention Data 1-49.

C. Thickness shall be as required to match substrate or insulation height/

D. Any existing woodwork which is to be reused shall be firmly anchored in place (shall resist a minimum force of 175 pounds per linear foot in any direction) and free of rot. Only woodwork designated to be reused in detail drawings shall be left in place and all other woodwork shall be removed.

3.08 MEMBRANE FLASHINGS

A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the University's Representative. Approval shall only be for specific locations on specific dates. Flashings shall be adhered to compatible, dry smooth, and solvent-resistant surfaces.

B. Contact Adhesive for Flashings

1. Over the properly installed and prepared substrate surface, contact adhesive shall be applied using approved solvent-resistant ¾” nap paint rollers. The adhesive shall be applied in smooth, even coatings with no holidays, globs, puddles or similar irregularities. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The surface with adhesive coating shall be allowed to dry completely prior to installing the membrane.

Note: Drying time increases with cooler temperature. Also, the Contractor is cautioned against work on days of high humidity because of extremely slow
evaporation of the solvent. The contractor shall check with the PVC manufacturer's technical representative prior to roof operations on such days.

2. When the surface is dry, the PVC flashing membrane is cut to a workable length and the underside shall be evenly coated with contact adhesive at a rate of ½ gallon per 100 sq. ft. When the adhesive had dried sufficiently to produce strings when touched with a dry finer, the coated membrane shall be rolled onto the previously-coated substrate being careful avoid wrinkles. Do not allow adhesive on the underside of the membrane to completely dry. The amount of membrane that can be coated with adhesive before applying to substrate will be determined by ambient temperature, humidity, and manpower. Adjacent sheets shall be overlapped a minimum of 4”. Flashings shall extend 5” onto the roofing membrane. The bonded sheet shall be pressed firmly in place with a hand roller.

3. No bonding adhesives shall be applied in lap areas that are to be welded to flashing or adjacent sheets. All sheets shall be applied in the same manner, lapping all sheets as required by welding techniques.

C. All flashings shall extend a minimum of 8” above roofing level unless previously accepted by University's Representative.

D. All flashing membranes shall be fully adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded at their joints and at their connections with the roof membrane.

E. All flashings shall be hot-air welded at their joints and at their connections with the roof membrane.

F. All flashing membranes shall be mechanically fastened along the tip edge through tin discs spaced a maximum of 1’ on center, or pre-drilled metal strips where so specified in the
specifications. Expansion pins with nylon sheaths set in pre-drilled holes shall be used to secure flashings to masonry and concrete surfaces.

3.09 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirement of the following:

1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).

2. Sheet Metal and Air Conditioning Contractors National Association (SMACCA), (latest issue).

B. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily

C. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

D. Metal joints shall be watertight.

E. Metal flashings shall have a 4” minimum nailing flange and shall be fastened into solid wood blocking with fasteners of the same type with two rows of annular ring nails, 4” on center, staggered. Fasteners shall penetrate the wood nailer a minimum if 1-¼”.

F. Continuous metal hook strips are required if clad metal fascia exceeds 5” in width. Hook strip is to be fastened 12” on center into wood nailer or masonry wall.
3.10 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. When a break in the day's work occurs in the central area of a roof, a temporary waterstop shall be constructed to provide a 100% watertight seal. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of roof cement of 6" girth. When work resumes, the contaminated PVC membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc., shall be removed from the work area and disposed of off site. None of these materials shall be used in the new work.

B. If inclement weather occurs while a temporary waterstop is in place, the Contractor shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Contractor's expense.

3.11 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the University's Representative and Contractor. All defects noted, non-compliance with the specifications or the recommendation of University's Representative shall be itemized in a punch list. These items must be corrected immediately by the Contractor prior to demobilization to the satisfaction of the University's Representative.

B. All warranties, as required in Division 1 "Closeout Submittals" of this specification shall be submitted for approval prior to final payment.

C. Contractor shall perform a flood test at the completion of the work to demonstrate the watertight integrity of the finished product to the satisfaction of the University's Representative.

D. Inspections by UCD Fire Department must be completed and the job finalized as a condition of completion.

END OF SECTION 07530
SECTION 07600
FLASHING AND SHEET METAL

PART I - GENERAL

1.01 DESCRIPTION:

A. Scope: Work under this Section shall include all materials and installation necessary to provide Flashing and Sheet Metal, as shown and detailed on the drawings and specified herein.

B. Related Work Specified Elsewhere:
   1. Division 5, Section 05500 – Miscellaneous Metal Fabrications
   2. Division 7, Section 07310 – Roof Coverings
   3. Division 9, Section 09900 – Painting

1.02 QUALITY ASSURANCE

A. References:

B. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience; manufacturer approved.

1.03 SUBMITTALS

A. General: Refer to Section 01330 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings: None required for specified products; required for alternate products.

C. Samples: If specifically requested.

D. Product Data: None required for specified products; required for alternate products.

1.04 PRODUCT HANDLING

A. General: Refer to Section 01310 – COORDINATION.

B. Storage: Stack preformed material to prevent twisting, bending or abrasion; slope to ensure drainage.

1.05 MAINTENANCE

A. General: Refer to Section 01770 – CLOSEOUT PROCEDURES
PART II - PRODUCTS

2.01 MATERIALS

A. Sheet Material:

1. Galvanized Sheet Metal: ASTM A446, Grade A, G90 zinc coating; 24 gage minimum, core steel.


B. Underlayment: ASTM D226, 15 lb. asphalt saturated roofing felt, unperforated.

C. Fasteners:

1. Nails:
   b. Steel Nails: Hot-dipped galvanized, annular thread, size as required.
   c. Concrete Nails: Flat head, size as required.
   d. Aluminum Nails: Annular thread, size as required.

2. Rivets: ⅛” diameter; solid type.

3. Washers: Lead or neoprene, where required.

4. Lead Plugs: Size as required.

D. Solder:


2. Flux: FS O-F-506.

E. Galvanizing Repair Treatment:

1. Rod: Per ASTM A780.

2. Coating: Per MIL-P-46105.

F. Protective Coatings:

1. General: FS TT-C-494, Type II; bituminous.


G. Plastic Cement: FS SS-C-153, Type I; asphaltic.

H. Sealing Tape:
1. No. 606 Architectural Sealant Tape as manufactured by Protective Treatments, Inc.,

2. Or equal, no known equal.

I. Sealants: FS TT-S-230, non-hardening, non-sagging.

2.02 COMPONENTS

A. Reglets:

1. O'Keefe's, Inc.; extruded aluminum with butyl rubber sealer and removable snap-in base flashing.

2. Or equal, no known equal.

3. Cast-in-Place Concrete: Type C.

4. Masonry: Type M.

5. Surface Applied: Type E.

2.03 FABRICATION

A. Manufacture:

1. General: Form sections, per referenced standards, true to shape, accurate in size, square, and free from distortion or defects. Form pieces in single length sheets, not to exceed 10'-0" in length. Hem exposed edges on underside ½"; miter and seam corners.

2. Seams: Flat lock.

3. Corners: One piece with minimum 18" long legs; solder for rigidity, seal with sealant.


5. Vertical Faces: Bottom edge formed outward ¼" and hemmed to form drip.

6. Flashing Toe: Extend toe 2" over roofing; return and brake edges.

7. Soldering: Solder shop formed metal joints. After soldering, remove flux; wipe and wash solder joints clean. Weather seal joints.


B. Assemblies:

1. General: Fabricate with galvanized sheet metal, unless otherwise shown.
2. Flashing:
   a. Exterior Hollow Metal Frame Flashing: 18 gages, as shown.
   b. Gravel Stops: Form corners with interlocking joint, soldered and ground smooth.

3. Roof Drainage:
   a. Overflows and Scuppers: As detailed, with flange and outlet hemmed and joints fully soldered.

PART III - EXECUTION

3.01 PREPARATION

A. General: Refer to Section 01310 – COORDINATION.

B. Examination: Examine conditions of work in place before beginning work; report defects.

C. Measurements: Take field measurements; report variance between plan and field dimensions.

3.02 INSTALLATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Underlayment: Apply one (1) layer of felt underlayment over surfaces as shown; lap all edges 6” minimum, in direction of slope.

C. Application:
   1. General: Make corners square, surfaces true and straight in planes, and lines accurate to profiles. Fit sheet metal tight in place; secure using concealed
fasteners. Apply plastic cement compound between metal flashings and felt flashings. Seal metal joints watertight.

2. Expansion and Contraction: Allow for expansion and contraction over an ambient temperature range up to 150ºF; distortions resulting from fastening or expansion and contraction stresses not acceptable

3. Dissimilar Metals: Isolate with heavy coat of bituminous paint. Coat all sheet metal in contact with roofing felts.

D. Components: Install as shown; set flashing to form watertight fit.

E. Assemblies:

1. Flashing:
   a. General: Install flashings where shown; miter and solder joints at corners. Lap joints in counterflashing at least 6” and make watertight with sealing tape. Extend counterflashing down not less than 6”.
   b. Exterior Hollow Metal Frame Flashing: Provide at frame heads, as shown.
   c. Gravel Stops: Set on top of roofing felts in ⅛” thick bed of plastic cement, with laps filled; close ends at scuppers.

2. Overflows and Scuppers: As shown; fit outlet tightly into collar flashing.

F. Sealants: As shown; per manufacturer’s directions.

G. Galvanizing Repair Treatment: Repair damaged zinc coating with specified repair compound, as required.

3.03 CLEANING

A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris and thoroughly clean exposed surfaces.

END OF SECTION 07600
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:
   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. Interior Joints: Acrylic Latex.
C. Joint Cleaner: Provide cleaner recommended by sealant manufacturer for specific joint surface and condition.
D. Joint Primer and Sealer: As recommended by sealant manufacturer for each condition.
E. Bond Breaker Tape: Pressure sensitive polyethylene tape.
F. Other Materials: Manufacturer's standard for items required or type best suited for intended use.

PART III - EXECUTION
3.01 PREPARATION
A. General: Refer to Section 01310 – COORDINATION.
B. Conditions Of Work In Place:
   1. General: Carefully examine before beginning work; report defects.
   2. Substrate: Inspect surfaces to insure that no bond-breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired.
C. Preparation Of Surfaces:
1. Surfaces: Prepare joints in accordance with manufacturer's recommended instruction to ensure maximum adhesion. Prime as required, protecting adjacent exposed surfaces.

2. Sealants: Prepare sealant as required, including proper mixing of multicomponent sealants.

3.02 APPLICATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Protection: Protect surfaces adjacent to joints to receive sealant. Cover joints in walking surfaces with heavy duty, non-staining tape, until material has dried.

C. Installation:

1. General: Install sealant materials per manufacturer's instructions. Prevent three-sided adhesion. Provide sealant depth of ½ joint width; minimum depth of ¼"; maximum of ½", unless otherwise required by the manufacturer.

2. Backer Rod: Install using blunt or rounded tools to insure uniform (±⅛") depth without puncturing material. Use oversize backer rod; minimum of 33% for closed cell type; minimum of 50% for open cell type, unless otherwise required by the manufacturer.

3.03 CLEANING

A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions. Perform cleaning in a manner that will not affect the appearance of the sealant or the adjacent finish material.

END OF SECTION 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.

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.

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.

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. Interior (Non-rated): SDI-100 Grade II, Model 1.

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. Vision Light Frames: Model No. BFL-75; glass and glazing per Division 8 "Glass and Glazing" as shown.
   b. Fasteners: Manufacturer's standard; tamperproof.

4. Astragals: ¼" 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. Interior Frames: 16 gauge; 14 gauge for frames over 3'-0" wide or fire rated.

D. Finish: Color as selected by the University's Representative. See finish schedule.

2.03 FABRICATION

A. 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. Glazed Lights:
a. General: As shown; provide applied stops as required.

3. 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.

4. 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.

5. Silencers:
   a. Single 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.

6. Sound Deadening: Coat inside (concealed) faces of doorframes in hollow wall construction. Apply emulsion over shop primer ⅛" thick and dry thoroughly before handling.

B. Anchors:
   1. General: Fabricate 16 gauge x 2" wide anchors of same material used for door frames.
   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.
         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: \( \frac{1}{8} '' \) 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 08210
WOOD DOORS

PART I - GENERAL

1.01 DESCRIPTION
A. Scope: Work under this Section shall include all materials and installation necessary to provide Wood Doors as shown and detailed on the Drawings and shown herein.

1.02 QUALITY ASSURANCE
A. References:

B. Labels: Provide proper Underwriters’ Laboratories, Inc. label for wood doors in fire-rated openings.

C. Testing: One (1) or more doors, of each type, may be selected at random from those delivered for testing. Those tested or cut apart will be used to determine compliance with specified requirements; noncompliance is basis for rejection of all of that kind and type of door delivered to the site. Acceptable doors used for testing will be replaced at University's expense.

1.03 SUBMITTALS
A. Product Data: Submit manufacturer's specification, data, and installation instructions for review.

B. Certificates: Submit WIC Certified Compliance Certificate for Installation.

1.04 PRODUCT HANDLING
A. Do not use packing materials that will stain or discolor door surface.

B. Storage: Per WIC Technical Bulletin No. 420-R for flush doors and No. 416-R for fire rated doors. Store materials under cover, in heated rooms and protected from damage, including exposure to excess humidity.

1.05 MAINTENANCE
A. Guarantee: Provide in required form for a period of two (2) years from date of final acceptance by University.
PART II - PRODUCTS

2.01 MATERIALS

A. Wood Doors:

1. General: Conform to WIC Custom Grade Standards.

2. Manufacture:
   a. Architectural Doors manufactured by Haley Bros., Inc., Architectural Door Division of the Weyerhaeuser Co., or equal.

3. Flush Type:
   b. Construction:
      1) Hollow Core: Expanded corrugated honeycomb.
      2) Solid Core:
         a) Unrated and 20 Minute: Staved lumber [Particleboard].
      3) Edge-bands: NWMA hardwood.
   c. Facing:
      1) Hardwood: Birch; plain sliced.
   d. Adhesive: PS 51 Type I and II.
   e. Accessories:
      1) Anemostat Door Products Division of the Dynamics Corporation of America, Air Louvers, Inc., or equal.
      2) Louvers:
         a) General: Model No. AFDL.
         b) Fire Rated: Model No. FLDL-UL.
      3) Vision Light Frames: Model No. BFL-75; glass and glazing per Division 8, Section 08810 – Glass and Glazing, as shown.
      4) Fasteners: Manufacturer's standard; tamperproof.
   f. Finish: Manufacturer's standard finish as selected by University's Representative per Division 9, Section 09900 – Painting.

4. Style and Rail Type:
a. Construction: 1-¾” thick Douglas fir [birch][red oak][white oak][mahogany][walnut]; solid lumber construction, as shown.

b. Adhesive: PS 51 Type I and II.

c. Finish: Manufacturer's standard finish as selected by University's Representative per Division 9, Section 09900 – Painting.

PART III - EXECUTION

3.01 PREPARATION

A. Examination: Examine conditions of work in place before beginning work; report defects. Verify that doorframes are the type required for door and are properly installed. Install fire rated doors only in corresponding fire rated frames.

3.02 INSTALLATION

A. General: Install in strict conformance with NFPA Pamphlet No. 80 "Installation of Fire Doors", other referenced standards, the manufacturer's written directions, as shown, and as herein specified. Make manufacturer's instructions available to the inspecting authorities.

B. Tolerances:

1. General: Maximum distortion measured with straight edge or taught string, corner to corner, over an imaginary 36" x 84" surface area.

2. Diagonal (Warp), Vertical (Bow) and Width (Cup): ⅛”.

C. Hardware: Per Division 8, Section 08710 – Finish Hardware. Fit doors to specified clearances; do not trim job fitted doors more than ¼” from any edge.

D. Glazing: Per Division 8, Section 08810 – Glass and Glazing.
E. Finishing:

1. General: Per Division 9, Section 09900 – Painting.

2. Priming: Prime or seal tops and bottoms of doors immediately upon delivery, unless factory sealed.

3. Preparation for Finishing: Use 150 grit sandpaper to remove handling marks or effects of exposure to moisture; steam out deep scratches, to satisfaction of University's Representative, and clean finish sand exposed surfaces before application of sealer or finish.

4. All electrically operated locks and strikes and locking hardware shall operate on 24 volts DC. All hardware shall use the manufactures recommended power supply. Power supplies shall be equipped with battery backup large enough to provide for 24 hours of operation with the door to remain locked. All electric strikes and electric locks shall be manufactured by Von Duprin, Schlage or Folger Adams. No substitutions allowed unless approved by University.

5. All doors that are in a fire rated wall must use electric locks that ensure positive latching at all times. When panic hardware has electric latch retraction and it is unlocked or in the day mode it is not latched this hardware is not permitted. The Fire Marshal has stated that the use of an electric strike in the unlocked position is not positively latched.

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 08210
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:
   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:
   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.

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


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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Specified</th>
<th>Acceptable Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges:</td>
<td>Hager</td>
<td>Stanley, Ives</td>
</tr>
<tr>
<td>Interior Doors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locks and Cylinders:</td>
<td>Schlage “ND” series</td>
<td>No known equal</td>
</tr>
<tr>
<td>Closers:</td>
<td>LCN 4040</td>
<td>Dorma, Yale</td>
</tr>
<tr>
<td>Floor/Wall Stops:</td>
<td>Glynn Johnson</td>
<td>Brass; Quality</td>
</tr>
<tr>
<td>Exit Devices:</td>
<td>Von Duprin</td>
<td>No known equal</td>
</tr>
<tr>
<td>Astragals:</td>
<td>Pemko</td>
<td>National Guard, Zero</td>
</tr>
<tr>
<td>Thresholds and Weatherstrip</td>
<td>Pemco</td>
<td>National Guard; Zero</td>
</tr>
<tr>
<td>Silencers:</td>
<td>Brass</td>
<td>Quality, Signature</td>
</tr>
<tr>
<td>Trim:</td>
<td>Signature Brass</td>
<td>Door Controls Int’1; Quality</td>
</tr>
<tr>
<td>Flush Bolt Coordinators:</td>
<td>Ives</td>
<td>No known equal</td>
</tr>
<tr>
<td>Key Cabinet:</td>
<td>Door Controls Intl.</td>
<td>H.B.Ives;Telkee; Lund; Key Control Systems, Inc.</td>
</tr>
</tbody>
</table>

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. 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.

5. 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 1-⅜” thick and up to 2'-4" wide: 3-½" butts.
      2) Doors 1-⅜” inch thick over 2'-4" to 3'-0" Wide: 4” butts.
      3) Doors 1-⅝” thick up to 3'-0" wide: 4-½” butts.
      4) Doors 1-⅞” thick over 3'-0" wide: 5” butts.
      5) Note: All butts shall be of proper width to clear trim in projection to allow 180º swing and that width shall be determined by the following rules:
      6) For doors up to 2-¼” thick: twice the door thickness, plus trim projection, less ½”, equals the proper hinge width. For doors 2-¼” to 3” thick: twice the door thickness, plus trim projection, less ¾” 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 UCDMC 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.


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: 3⁄8” maximum over floor or threshold.
   2. No Threshold: ¾” maximum for metal doors; ⅝” maximum for wood doors.
   3. Threshold: ⅛” typical.
   4. Carpet: ⅛” 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 # 1, Office, See Drawing / Door Schedule

2. Group # 2, Conference Room, See Drawing / Door Schedule

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. 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. Environmental Requirements: Do not install wallboard or joint compounds if building temperature is below 55°F. Provide proper ventilation to eliminate excessive moisture from building.

B. Protection: Avoid exposure to weather; use protective covering. Protect from soiling and construction damage. Water stained gypsum board sheets shall not be installed. Installed water stained gypsum board sheets will be removed and replaced at Contractor’s expense.
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; ⅝” 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:
   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; 4’-0" x 8'-0” x ⅝”, square edge, water resistant boards at wet locations.

G. Fasteners:

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 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
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):

4. American national Standards Institute, (ANSI):
   a. A108.5 – “Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar”.
   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 50ºF (10ºC) 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:


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 0.6

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:
   b. External Corners for Thinset Installations: Surface bullnose.
   c. Internal Corners: Field-butted 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 ½” to ¼” 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 Solid Epoxy 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 for wall and floor, 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.
   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
   3. Armstrong Commercial Ceiling

B. Acoustical Panels:
   1. See Finish Schedule on ID Sheet

C. Acoustical Tile:
   1. See Finish Schedule on ID Sheet
2. Adhesive: As recommended by acoustical tile manufacturer.

D. 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

E. Acoustical Sealant: As recommended by acoustical material manufacturer, for application shown.

F. 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 ¾" 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.

E. 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.

F. 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.

G. 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: ⅛" in 10'-0".

3.04 CLEANING

A. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

END OF SECTION 09510
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. Resilient Plank Flooring

B. Related Sections include the following:

1. Division 7 – Water Vapor Emission Control Barrier
2. 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 50º and 90ºF.

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 65ºF or more than 100ºF 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 55ºF or more than 95ºF.

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: Mannington, Armstrong, Tarket, Azrock, or equal.

2.02 RESILIENT TILE

A. See Finish Schedule on ID Sheet

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: Armstrong. or equal.

2. See Finish Schedule

3. Class: Class 2 - through pattern

4. Thickness: ¼" (3.2 mm)

5. Size: 12” x 24” tile

6. Static Load Limit: 75 psi (5.27 kg/cm²) per test method ASTM F 970.

7. Fire Test Data: Class 1.

END OF SECTION 09651
PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work of this Section shall include all materials and installation necessary to provide Resilient Wall Base and Accessories, including resilient wall base, resilient stair
accessories, resilient flooring accessories, resilient carpet accessories, as shown and
detailed on the Drawings and specified herein.

B. Related Sections include the following:

1. Division 7, Section 07268 - WATER VAPOR EMISSION CONTROL BARRIER
2. Division 9, Section 09651 – RESILIENT TILE FLOORING
3. Division 9, Section 09652 – SHEET FLOOR COVERING

1.02 SUBMITTALS

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

B. Samples for Verification: In manufacturer's standard sizes, but not less than 12" long, of
each product color and pattern specified.

C. Product Certificates: Signed by manufacturers of resilient wall base and accessories
certifying that each product furnished complies with requirements.

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 and color of product 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 products to Project site in manufacturer's original, unopened cartons and
containers, each bearing names of product and manufacturer, Project location, including
dye lot number and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures
maintained between 50º and 90ºF.

C. 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 70°F or more than 95°F in spaces to receive resilient products 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 post-installation period, maintain a temperature of not less than 55°F or more than 95°F for a minimum of 48 hours.

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.06 EXTRA MATERIALS

A. Furnish extra materials installed, as described below packaged with protective covering for storage, and identified with labels describing contents.

1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each different type, color, pattern, and size of resilient product installed.

2. 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 Flooring Accessory 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 Flooring Accessory Schedule at the end of Part 3.

2.02 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Flooring Accessory Schedule.

B. Vinyl Wall Base: Products complying with FS SS-W-40, Type II and with requirements specified in the Resilient Flooring Accessory Schedule.
RESILIENT PRODUCTS

C. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Tile Flooring Schedule.

D. Vinyl Wall Base: Products complying with FS SS-W-40, Type II and with requirements specified in the Resilient Tile Flooring Schedule.

E. Rubber Stair Treads: Products of style suitable for use indicated and complying with FS RR-T-650, Composition A and with requirements specified in the Resilient Tile Flooring Schedule.

F. Vinyl Stair Treads: Products of style suitable for use indicated and complying with FS RR-T-650, Composition B and with requirements specified in the Resilient Tile Flooring Schedule.

G. Risers: Products of same manufacturer as stair treads and complying with requirements specified in the Resilient Tile Flooring Schedule.

H. Stringers: Products of same manufacturer as stair treads and complying with requirements specified in the Resilient Tile Flooring Schedule.

I. Rubber Accessory Moldings: Products complying with requirements specified in the Resilient Tile Flooring Schedule.

J. Vinyl Accessory Moldings: Products complying 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 resilient product 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.

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 manufacturer's recommended bond and Calcium Chloride Test for moisture. Concrete slabs moisture should not exceed 5 lbs. per 1,000 sq. ft. per 24 hours.
Provide University's Representative with test results prior to installation for all concrete slabs.

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. 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


4. ASTM F 710 – Standard test to measure Alkalinity levels conducted with an electronic PH Meter manufactured by Wagner Electronics.

C. Subfloor Finishes comply with requirements specified in "Division 3, Section 03300 Cast-In-Place Concrete for new slabs receiving resilient flooring.

1. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. 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.

E. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Division 6 - ROUGH CARPENTRY."

2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

F. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 PREPARATION

A. General: Comply with 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 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 installing resilient products. 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: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and
remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.04 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

2. Sweep or vacuum horizontal surfaces thoroughly.

3. Do not wash resilient products until after time period recommended by resilient product manufacturer.

4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products 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 resilient product manufacturer.

1. Apply protective floor polish to vinyl resilient products installed on floors and stairs that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.
   a. Use commercially available product acceptable to resilient product manufacturer.
   b. Coordinate selection of floor polish with University's maintenance service.

2. Cover resilient products installed on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.

C. Clean resilient products 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, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.

2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with University's maintenance program.

3.05 RESILIENT FLOORING ACCESSORY SCHEDULE

A. Rubber Wall Base B1:
   1. Products: Wall Base, as manufactured by Johnsonite, or equal.
   2. Color and Pattern: See finish schedule on ID Sheet
   4. Minimum Thickness: ⅛".
   5. Height: 4"
   7. Outside Corners: Formed on site.
   8. Inside Corners: Formed on site.
   10. Surface: Smooth.

B. Rubber Stair Treads and Accessories ST1
   1. Products: See Finish Schedule on ID Sheet
C. Vinyl Stair Treads and Accessories

1. **Products:** See Finish Schedule on ID Sheet

END OF SECTION 09653
SECTION 09681
CARPET TILE

PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work under this Section shall include all materials and installation necessary to provide Carpet Tiles as shown and detailed on the Drawings and specified herein, including:

1. Carpet tiles

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 indicated. Include manufacturer's written data on physical characteristics, durability, fade resistance and warranty. Include installation recommendations for each type of substrate required.

1. Including the intended adhesive for each product and subsurface.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Existing flooring materials to remain.
3. Carpet type, color, and dye lot.
4. Locations where dye lot changes occur.
5. Seam locations, types, and methods.
6. Pattern type, repeat size, location, and starting point.
7. Pile direction: Identify if carpet is quarter turned or not.
8. Type, color, pile direction, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

2. Flooring Accessories: Standard manufacturers sample size only in color selected.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.04 Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, warranty and performance. Other manufacturers' products must be comparable in appearance, construction, warranty, and performance to named products and comply with all requirements to be considered. Refer to Division 1 Section "Substitutions."

1.05 FIELD SAMPLES AND MOCK-UPS

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

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

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

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.07 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for the Project when occupied for its intended use.

C. Examine existing substrate areas and do not install carpet tiles until concrete slabs have cured and are sufficiently dry to bond with adhesives. See section 3.01 Examination and comply with all the requirements.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items. EXCEPTION: Carpet replacement projects can use a lift system (if appropriate) to enable tiles to be installed under furniture.

1.08 WARRANTY

A. Carpet Warranty: written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period.
Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.

Wear: Limited Lifetime Wear and Backing Warranty

1. Static: Lifetime of carpet.

2. Edge Ravel: Lifetime of carpet. Guaranteed no edge ravel in normal use.

3. Delamination: Lifetime of carpet with normal use. Chair pads not required but are recommended for maximum texture retention.


5. Adhesive: Lifetime of carpet.


1.09 EXTRA MATERIALS

A. At the completion of the carpet installation furnish extra materials described below to the University’s Representative. Extra materials are to be packaged in the original boxes with
protective covering for storage and identified with labels describing contents and Project location.

1. Carpet: Full-tiles equal to 5% of amount installed for each type indicated, but not less than 10 sq. yd.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS & YARN TYPE

1. Mannington – Type 6.6 (use current UC Purchasing Agreement)
2. Bentley – Type 6.6 (use current UC Purchasing Agreement)
3. Lee’s – Type 6.6 (use current UC Purchasing Agreement)

2.02 CARPET

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturer: Mannington, or equal. (Consultant to modify per project)

1. Style Name: See Finish Schedule on ID Sheet

C. Performance Characteristics: As follows:

1. Static: 3.0 KV, Standard Shuffle Test [70°F (21°C); 20% RH]
2. Flammability: Passes DOC-FF-1-70 Pill Test
3. Flooring Radiant Panel Test: Meets NFPA Class 1 for ASTM E-648 glue down
4. Smoke Density: NBS Smoke Chamber NFPA-298, less than 455 flaming mode
5. Construction Materials: 100% man-made
6. Dimensionally stable

2.03 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:

1. Carpet manufacturer.

B. Adhesives: Green label, Non-flammable water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability and emissions requirements and for installed carpet and that is recommended by the following:

1. Carpet manufacturer.

C. Protective Edge Strips: Style and height required to protect exposed edge of carpet: Provide in maximum lengths to minimize abutted 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 and dryness by performing flooring manufacturer's recommended bond and Calcium Chloride Test for moisture. Concrete slabs moisture should not exceed 5 lbs. per 1,000 sq. ft. per 24 hours. Provide University's Representative with test results prior to installation for all concrete slabs.

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. 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


4. ASTM F 710 – Standard test to measure Alkalinity levels conducted with an electronic PH Meter manufactured by Wagner Electronics.

C. Subfloor Finishes comply with requirements specified in "Division 3, Section 03300 Cast-In-Place Concrete for new slabs receiving resilient flooring.

1. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. 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.

E. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Division 6 - ROUGH CARPENTRY."

2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

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

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Cracks and holes in sub-floor should be filled with a quality latex underlayment powder and sealed with a latex admixture. Seal all dry, porous concrete slabs with an appropriate
sealer. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Subfloors must be structurally sound, dry, and free of dust, dirt, paint, grease, curing agents, and foreign matter.

D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
   1. Carpet manufacturer.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Direct-Glue-Down Installation: Comply with written manufacturer's installation instructions.

B. Comply with carpet manufacturer's written recommendations for seam locations and pile direction. At doorways, center seams under the door in closed position.

C. Do not use more than one (1) dye lot in a room. If more than one (1) dye lot is required, show split on shop drawings.

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, 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 nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."
C. Protect carpet against 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 carpet manufacturer.

END OF SECTION 09681
PART I - GENERAL

1.01 RELATED DOCUMENTS

A. Scope: Work under this Section shall include all materials and installation necessary to provide Painting including: exposed exterior items and surfaces, exposed interior items and surfaces, surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections as shown and detailed on the Drawings and specified herein.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent
materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Architectural woodwork and casework
   b. Acoustical wall panels
   c. Metal toilet enclosures
   d. Metal lockers
   e. Unit kitchens
   f. Elevator entrance doors and frames
   g. Elevator equipment
   h. Finished mechanical and electrical equipment
   i. Light fixtures
   j. Distribution cabinets

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces
   b. Furred areas
   c. Ceiling plenums
   d. Utility tunnels
   e. Pipe spaces
   f. Duct shafts
   g. Elevator shafts

3. Finished metal surfaces include the following:
   a. Anodized aluminum
   b. Stainless steel
c. Chromium plate  
d. Copper  
e. Bronze and brass

4. Operating parts include moving parts of operating equipment and the following:  
a. Valve and damper operators  
b. Linkages  
c. Sensing devices  
d. Motor and fan shafts

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
2. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
3. Division 5 Section "Structural Steel" for shop priming structural steel.
4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
5. Division 6 Section "Exterior Architectural Woodwork" for shop priming exterior architectural woodwork.
6. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
7. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
8. Division 8 Section "Wood Windows" for shop priming unclad wood windows.
9. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.
10. Division 9 Section "Special Coatings" for industrial paints and maintenance and special coatings.
11. Division 9 Section "Multicolored Interior Coatings" for spray-applied multicolored coatings.
12. Division 9 Section "Exterior Wood Stains" for exterior wood stains.
13. Division 9 Section "Wall Coverings" for substrate sealer under wall coverings.
14. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

15. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.02 Definitions

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 10 when measured at an 85° meter.

2. Eggshell refers to low-sheen finish with a gloss range between 10 to 15 when measured at a 60° meter.

3. Satin refers to low-sheen finish with a gloss range between 30 to 35 when measured at a 60° meter.

4. Semi-gloss refers to medium-sheen finish with a gloss range between 50 to 55 when measured at a 60° meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 75 when measured at a 60° meter.

1.03 Submittals

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for each color selection verification; of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each sample. Identify the manufacturer base paint information intended for each paint color. Label each
sample with same identification number, manufacturer color name/number as listed in the finish schedule.

3. Submit Samples: 8-½" x 11" brush-outs for the Architect's review for each color and texture specified.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats unless specified otherwise.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

   a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.

   b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

   a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be determined by University's Representative and designer.

D. Contractor shall notify the University's Representative prior to the application of each coat of primer and paint to verify color and coating system.

1.01 FIELD SAMPLES AND MOCK-UPS

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

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

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

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

1.02 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material
2. Product description (generic classification or binder type)
3. Manufacturer's stock number and date of manufacture
4. Contents by volume, for pigment and vehicle constituents
5. Thinning instructions
6. Application instructions
7. Color name and number
8. VOC content

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45ºF. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.03 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50º and 90ºF.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45º and 95ºF.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or at temperatures less than 5ºF above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
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, products listed in the paint schedules.

B. Products: Provide one of the products identified in the paint schedule for the base paint. Actual paint colors may be specified from other manufacturer. Add formulated colorants as required to base paint to achieve color specified.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Kelly Moore Paints (KM)
2. Sherwin-Williams Co. (S-W)
3. Or equal.

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data
PART III - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. Art and signage will be removed by the University. Notify the University’s representative well in advance of the intended removal date.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved. Notify University’s representative to reinstall items the University removed.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5% solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

c. When transparent finish is required, backprime with spar varnish.

d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.

e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign
substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.
3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.


3. Tanks.

4. Ductwork.

5. Insulation.

6. Motors and mechanical equipment.

7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.

2. Switchgear.

3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. The University reserves the right engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

1. The University may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be
required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

      1) Kelly Moore Paints (KM) 971 Acry-Plex PVA Primer
      2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall Primer, B28W200
      3) Or equal.

   b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

      1) Kelly Moore, (KM) 550 Premium Flat
      2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Flat, B30W200 series
      3) ICI Paints 1210 Ultra-Hide Acrylic Flat

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore, (KM) 971 PVA Primer
2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall Primer, B28W200
3) ICI Paints 1030 Ultra-Hide PUA

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Egshel, B20W200 series
3) Or equal.


a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer
2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall Primer, B28W200
3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series
3) Or equal.


a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer
2) Sherwin-Williams Co. (S-W) Preprite ProMar Interior Latex Wall Primer, B28W200

3) Or equal.

b. First and Second Coats: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall Primer, B28W200

3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

1) Kelly Moore (KM) 1680 Dura-Poxy Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Interior Latex Gloss, B21W200 series

3) Or equal.


a. Primer: Alkyd- or latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 971 PVA Primer

2) Sherwin-Williams Co. (S-W) Preprite ProMar 200 Latex Wall Primer, B28W200

3) Or equal.
b. First and Second Coats: Odorless, full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series
3) Or equal.

B. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkyd- or acrylic-latex-based, interior wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat
2) Sherwin-Williams Co. (S-W) Prepite Wall & Wood Primer, B49WZ2
3) Or equal.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel
2) Sherwin-Williams Co. (S-W) ProMar Latex Egshel, B20W200 series
3) Or equal.


a. Undercoat: Alkyd or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading
rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore 1650 Premium Semi-Gloss

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.


a. Primer: Alkyd or latex-based, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat

2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2

3) Or equal.

b. First and Second Coats: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series

3) Or equal.


a. Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading
rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.1 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat
2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2
3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) ProClassic Waterborne Gloss Enamel, B21 series
3) Or equal.

5. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 975 Acry-Plex Enamel Undercoat
2) Sherwin-Williams Co. (S-W) Preprite Wall & Wood Primer, B49WZ2
3) Or equal.

b. First and Second Coats: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series
3) Or equal.


a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Old Masters Wood Grain Filler
2) Sherwin-Williams Co. (S-W) None Available
3) Or equal.

b. Stain Coat: Waterborne, interior wood stain applied at spreading rate recommended by the manufacturer.
   1) Old Masters Water Based Wood Stain
   2) Sherwin-Williams Co. (S-W) None Available
   3) Or equal.

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
   1) Old Masters Water Based Sanding Sealer
   2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
   3) Or equal.

d. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.
   1) Old Masters Water Based Polyurethane
   2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
   3) Or equal.

7. Water-Based, Full-Gloss, Varnish Finish: 2 finish coats of a waterborne, clear, full-gloss varnish over a sealer coat and an interior wood stain. Wipe filler before applying stain.

   a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Filler
      2) Sherwin-Williams Co. (S-W) None Available
      3) Or equal.

   b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Sanding Sealer
      2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish A68 series
      3) Or equal.
c. First and Second Finish Coats: Waterborne finish applied at spreading rate recommended by the manufacturer.
   1) Old Masters Water Based Polyurethane
   2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
   3) Or equal.

8. Alkyd-Based Stain, Wax-Polished Finish: 3 finish coats of paste wax over a sealer coat and an alkyd-based, interior wood stain.
   a. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.
      1) Old Masters Alkyd Wiping Stain
      2) Sherwin-Williams Co. (S-W) Wood Classics Interior Oil Stain, A48 series
      3) Or equal.
   b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Sanding Sealer
      2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding Sealer, B26V43
      3) Or equal.
   c. Second, Third, and Fourth Coats: Paste wax as recommended by the manufacturer.

   a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
      1) Old Masters Wood Grain Filler
      2) Sherwin-Williams Co. (S-W) None Available
      3) Or equal.
   b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Sanding Sealer
      2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
3) Or equal.

c. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.
   1) Old Masters Water Based Polyurethane
   2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
   3) Or equal.

10. Water-Based, Full-Gloss, Varnish Finish: 2 finish coats of a waterborne, clear, full-gloss varnish over a sealer coat. Wipe filler before applying stain.

   a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
      1) Old Masters Wood Grain Filler
      2) Sherwin-Williams Co. (S-W) None Available
      3) Or equal.

   b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Sanding Sealer
      2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
      3) Or equal.

   c. First and Second Finish Coats: Waterborne finish applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Polyurethane
      2) Sherwin-Williams Co. (S-W) Wood Classics Waterborne Polyurethane Varnish, A68 series
      3) Or equal.

11. Wax-Polished Finish: 3 finish coats of paste wax over a sanding-sealer first coat.

   a. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
      1) Old Masters Water Based Sanding Sealer
      2) Sherwin-Williams Co. (S-W) Wood Classics Fast Dry Sanding Sealer, B26V43
      3) Or equal.
b. Second, Third, and Fourth Coats: Paste wax as recommended by the manufacturer.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Flat Acrylic Finish: 2 finish coats over a primer.
   
a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   
   1) Rust-Oleum CV740
   
   2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series
   
   3) Or equal.
   
   b. First and Second Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.
   
   1) Kelly Moore (KM) 550 Premium Flat
   
   2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Flat, B30W200 series
   
   3) Or equal.

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
   
a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at
spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Eggshell, B20W200 series

3) Or equal.


a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate,
applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.

c. Finish Coat: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel

2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series

3) Or equal.


a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this
substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series
3) Or equal.

c. Finish Coat: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series
3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740
2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series
3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1680 Dura-Proxy Gloss Enamel
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Gloss, B21W200 series
3) Or equal.


a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at
spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Rust Oleum CV740

2) Sherwin-Williams Co. (S-W) Kem Bond HS, B50-Z series

3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or full-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this
substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series
3) Or equal.

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54Z-400 series
3) Or equal.

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30
3) Or equal.

b. First and Second Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 550 Premium Flat
2) Sherwin-Williams Co. (S-W) Promar 200 Latex Flat, B30W200 series
3) Or equal.

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30
3) Or equal.
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

1) Kelly Moore (KM) 1510 Premium Eggshell Enamel
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Eggshell, B20W200 series
3) Or equal.


a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30
3) Or equal.

b. First and Second Coats: Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

1) Kelly Moore (KM) 1650 Premium Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Semi-Gloss, B31W200 series
3) Or equal.

4. Semi-gloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30
3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this
substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss, A40 series
3) Or equal.

c. Finish Coat: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) Classic 99 Alkyd Semi-Gloss A40 series
3) Or equal.

5. Full-Gloss, Acrylic-Enamel Finish: 2 coats over a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30 series
3) Or equal.

b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

1) Kelly Moore (KM) 1680 Dura-Proxy Gloss Enamel
2) Sherwin-Williams Co. (S-W) ProMar 200 Latex Gloss, B21W200 series
3) Or equal.

6. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 5725 DTM Primer/Finish
2) Sherwin-Williams Co. (S-W) Galvite HS, B50WZ30
3) Or equal.

b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1930 Professional Semi-Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54-Z400 series
3) Or equal.

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Kelly Moore (KM) 1980 Professional Gloss Enamel
2) Sherwin-Williams Co. (S-W) Industrial Enamel, B54-Z400 series
3) Or equal.

E. Cotton or Canvas Covering over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: 2 finish coats. Add fungicidal agent to render fabric mildewproof.

   a. First and Second Coats: Flat, latex-based, interior paint applied at spreading rate recommended by the manufacturer.

      1) Kelly Moore (KM) 550 Premium Flat
      2) Sherwin-Williams Co. (S-W) DTM Acrylic Primer Finish, B66W1
      3) Or equal.

END OF SECTION 09900
PART I - GENERAL

1.01 DESCRIPTION

A. Scope: Work under this Section shall include all materials and installation necessary to provide Wall Coverings as shown and detailed on the Drawings and specified herein, including:

1. Vinyl wall covering.
2. Woven glass-fiber wall covering.
3. Wallpaper.
4. Heavy-duty, synthetic, textile wall covering.

B. Related Sections: The following Divisions contain requirements that relate to this Section:

1. Division 9, Section 09900 – PAINTING for primers, priming wall surfaces, coatings, and paint for woven glass-fiber wall coverings.

1.02 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1.

B. Product Data for each type of product specified. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

C. Shop Drawings showing location and extent of each wall covering type. Indicate seams and termination points.

D. Samples for verification in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Wall Covering Material: 8-½" x 11" memo sample.
   a. Submit sample with specified treatments applied.
   b. Mark top and face of material.
   c. Show complete pattern repeat.

E. Schedule of wall coverings using same room designations indicated on Drawings.

F. Product certificates signed by manufacturers of wall coverings certifying that their products comply with specified requirements.

G. Maintenance data for wall covering to include in the operation and maintenance manual specified in Division 1.
1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide wall coverings with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.

2. Smoke Developed: 450 or less.

1.04 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install wall covering until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work
above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.05 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Rolls of Wall Covering Material: Full-size units equal to 5% of amount of each type installed.

PART II - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, wall coverings that may be incorporated into the Work include, but are not limited to, the products specified in each wall covering Product Data sheet at end of this Section.

B. Products: Subject to compliance with requirements, provide one of the products specified in each wall covering Product Data sheet at end of this Section.

2.02 ADHESIVES

A. General: Mildew-resistant, nonstaining adhesive, for use with specific wood-veneer wall covering and substrate application, as recommended by wall covering manufacturer.

2.03 ACCESSORIES

A. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall covering manufacturer.

PART III - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.
C. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
   1. Painted Surfaces: Treat areas susceptible to pigment bleeding.
   2. Metals: If not factory primed, clean and apply rust-inhibitive zinc primer.
   3. Moisture Content: Maximum of 5% on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   4. Prime new gypsum board with primer recommended by wall covering manufacturer.
   5. Allow new plaster to cure. Treat areas of high alkalinity.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Install wall liner, with no gaps or overlaps, where required by wall covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.

F. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.03 INSTALLATION, GENERAL

A. General: Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps.

D. Match pattern 72” above finish floor.

E. Install seams vertical and plumb at least 6” from outside corners and 3” from inside corners. No horizontal seams.

F. Remove air bubbles, wrinkles, blisters, and other defects.

G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

3.04 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by wall covering manufacturer.

C. Replace strips that cannot be cleaned.

3.05 TEXTILE WALL COVERING PRODUCT DATA SHEET
A. Textile Wall Covering Designation: AP1, AP2. See Finish Schedule
B. Wall Covering Durability Standard: ASTM F 793.
C. Applied Backing Material
D. Width: 52"
E. Stain-Resistant Coating: DuPont "Tedlar" coating, complying with FS L-P-1040-B.
F. Performance Coating: "Scotchguard" by 3M Co.
G. Products: See Finish Schedule

END OF SECTION 09950
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 solid core laminate 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., Wilsonart, 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. Toilet partitions shall be overhead-braced (1092.67 Sierra Series), constructed of solid color reinforced composite material, which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins. Material shall have a non-ghosting, graffiti-resistant surface integrating bonded to care through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.

C. Stainless Steel: ASTM A167, Type 304.

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 1-¼" (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:


G. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:


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 ½" 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 30º 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
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, 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 70ºF 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 and sub has field verified all existing locations.

PART II - PRODUCTS

2.01 MANUFACTURERS

A. Manufacture for Hand Rails, Crash Rails, Corner Guards, Door and Wall Protection:

1. Sub to verify in field / identify existing retainer model to receive new covers to match existing style.

2.02 MATERIALS

A. Existing Retainers to receive new covers. See drawings.

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;
2.03 WALL GUARDS

A. Crash-Rail-Type Wall Guards: Existing to receive new covers. See drawings.
   1. Cover: Extruded, rigid plastic, minimum 0.080" thick, in profile indicated.

B. Retainer: Existing Retainers to receive new covers. See drawings.
   1. 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.

C. Bumper-Rail-Type Wall Guards: Existing to receive new covers. See drawings.
   1. Cover: Extruded, rigid plastic, minimum 0.080" thick or greater, in dimensions and profiles indicated.

D. Retainer: Existing Retainers to receive new covers. See drawings.
   1. 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 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.


C. Retainer: Existing Retainers to receive new covers. See drawings.
   1. 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.

2.05 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
2.06 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.

2.07 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.

2.08 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 manufacturers colors and color densities.

2.09 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
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 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.

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.

1. Work specified in this section:

1. Interior Signage

1.02 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; room signage, door signage, physical color chart

D. Product Data

1. Submit manufacturer’s, fabricator’s and finisher’s specification, installation and maintenance instructions.

1.03 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.

1.04 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.

2.02 COPY
A. Refer to Sign Standards Reference Document, Section 5, Part 2, 2.02, Paragraph A, B, and C

2.03 MATERIALS
A. Refer to Sign Standards Reference Document, 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 that 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
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:


1.03 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:


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, ¼” thick; sizes as shown.

   b. General: Stainless steel, with countersunk "theft proof" screws.

   c. Frame: A Series; size 24”x48”

   d. Backs: Resilient filler and galvanized steel backing plate, attach with "theft proof" concealed hangers.

2. Soap Dispensers: Provided by University, OFCI

3. Paper Towel Dispensers: Per UCDMC Environmental Services, OFCI

4. Roll Towel Dispenser: Per UCDMC Environmental Services, OFCI

5. Waste Receptacles: Bodrick Product # BOB270, or equal, no known equal.

6. Grab Bars: Bodrick Heavy Duty Grab Bars; 18 gage 1-¼” o.d. stainless steel tubing, Gamco, or equal.

7. Multi- Roll Toilet Tissue Dispensers: Per UCDMC Environmental Services, OFCI

8. Surface Mount: Georgia Pacific Cormatic per UCDMC Environmental Services, OFCI

9. Recessed Toilet Seat Cover Dispensers: Hospeco Product #TSC1, Gamco, or equal.

10. Sanitary Napkin Dispenser: Bobrick B-3500, Gamco, or equal.

11. Sanitary Napkin Receptacle: Bodrick #B3500, Gamco, or equal.

12. Hand Soap Dispenser: Medline Projects Per UCDMC Environmental Services, OFCI

13. Exidien Hand Sanitizing Lotion: Per UCDMC Environmental Services, OFCI
14. Hand Moisturizer Dispenser: Per UCDMC Environmental Services, OFCI

15. 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
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. Infant-care products
   2. 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
2. Or equal.

PART III - EXECUTION Not Applicable to this Section

END OF SECTION 10801
SECTION 12494
WINDOW SHADES

PART I - GENERAL

1.01 SUMMARY
A. This Section includes window shades.

1.02 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product specified.
B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, wiring diagrams and relationship to adjoining Work.
1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
C. Samples: For each exposed finish and for each color and shade cloth options.
D. Verification Sample: Provide a complete set of shade components, unassembled that demonstrates compliance with specified requirements. Mark face of materials to indicate interior faces.
E. Window Treatment Schedule: Use same room designations indicated on Drawings.
F. Maintenance data: Methods for maintaining roller shades, precautions regarding cleaning materials, instructions for operating hardware and controls.
G. Manufacturer's Certificates: Certify products meet or exceed specification requirements.

1.03 QUALITY ASSURANCE
A. Manufacturer Qualifications: Obtain roller shades through one source that provides a Life-Time guarantee.
B. Fire-Test-Response Characteristics: Provide shades with products passing flame-resistance testing according to NFPA 701.
C. Mock-Up: Provide a mock-up of each type of roller shade assembly for each mounting option for evaluation of appearance and accessories as indicated on drawings.
1. Locate mock-up in window(s) designated by University Representative.
2. Do not proceed with remaining work until mock-up is accepted by University Representative.

PART II - PRODUCTS

2.01 WINDOW SHADES
A. Manufacturer and Model: Draper, Inc., Clutch FlexShade XD for typical single window shade and dual roller for room darkening.
2.02 MANUALLY OPERATED WINDOW SHADES

A. Manually operated window shade with independent control. Manually operated, vertical roll-up, fabric window shades with components necessary for complete installation;

1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.

   a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Designer. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.

   b. Bead chain loop: Stainless steel bead chain.

2. Rollers: Extruded aluminum roller tube or appropriate diameter to support shade fabric with minimal deflection.

   a. Minimum roller tube diameter; 1.56 inches (40 mm).

   b. Fabric connection to roller tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.

   c. Fabric length: 6 inches (152 mm) greater than window height minimum.

   d. Bottom slat: 13/16 inch (20.6 mm) aluminum dowel, encased in bottom hem with heat sealed ends.

3. Mounting:

   a. Endcaps and fascia.

4. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall and jamb. Provide size compatible with roller size.

   a. Endcap Covers: To match fascia or headbox color.

5. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.

   a. Attachment: snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.

6. Hardware: Size appropriately for length of shade and for single or dual shade treatment.
2.3 FABRIC
   A. Color and pattern: As selected by Design Team from manufacturer’s standard range.
   B. Color and pattern: Style 2703 with 3% openness, color P13 Oyster/Beige. Single Shade.
   C. Color and pattern: Style 2703 with 3% openness, color P13 Oyster/Beige for face fabric with Draper SunBlock SB9000 color Oyster for second panel.

PART III - EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly prepared.
   B. If substrate preparation is the responsibility of another installer, notify University’s Representative of unsatisfactory preparation before proceeding.

3.02 PREPARATION
   A. Coordinate requirement for blocking and structural supports to ensure adequate means for installation of windows shades.

3.03 INSTALLATION
   A. Install shades level and plumb and aligned with adjacent units according to manufacturer's written instructions.
      1. Location: Locate shades to adequately clear interior face of glass or window frame.
   B. Ceiling mounted: Slim profile
   C. Installation: Install in accordance with manufacturer's instructions.
   D. Conceal Roller: Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
      1. Fascias

3.04 TESTING AND DEMONSTRATION
   A. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.
      1. Chain and clutch
   B. Demonstrate operation of shades to Owner’s Representative

3.05 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.
3.06 SCHEDULES

A. Refer to drawings for shade types and locations.

END OF SECTION 12494
PART I - GENERAL

1.01 RELATED SECTIONS

A. 15050 – Basic Mechanical Materials and Methods
B. 15060 – Pipes and Pipe Fittings
C. 15100 – Valves and Piping Specialties
D. 15250 – Mechanical Insulation
E. 15300 – Fire Protection
F. 15400 – Plumbing Piping Systems
G. 15440 – Plumbing Fixtures and Trim
H. 15450 – Plumbing Equipment
I. 15500 – Hydronic Systems and Equipment
J. 15890 – Ductwork
K. 15910 – Duct Accessories
L. 15990 – 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
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


13. AWWA 9th Edition

14. SMACNA Guidelines and Specifications

15. Other applicable state laws

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes.

C. Conform to State of California Energy Conservation Standards for all systems, equipment, and construction.

D. When contract documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge.

E. No material installed as part of this Work shall contain asbestos in any form.

1.03 QUALITY ASSURANCE:

A. Plumbers' Qualifications:

1. Plumbing: Certified in accordance with City of Sacramento, Chapter 9 of the Sacramento City Code, Article XXIV, Certification of Journey level Plumbers.

B. Show current certifications upon request.

C. Certification shall be copied and kept on file by Contractor for duration of the job and provided to University's Representative upon project completion.

1.04 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 01330 and 01610. Partial or incomplete lists of material will not be considered.

B. Installation of reviewed substitution is Contractor's responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost. Review by the University's Representative of the substituted equipment and/or dimensional Drawings does not waive these requirements.

1.08 EQUIPMENT DATA AND OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Submit equipment data and operation and maintenance instructions in accordance with Specification Section 01780, Closeout Submittal. Submit on all items for each and every system and piece of equipment furnished under these specifications. Equipment data to include full description of equipment, model number, serial number, nomenclature per Construction Documents, performance characteristics, performance curves and wiring diagrams. Best to include all information provided in the equipment submittal plus operation and maintenance instruction. Include copies of manufacturer's Guarantee/Warranty.

B. Contractor shall start compiling the above data, including operating and maintenance instruction data, catalog cuts and diagrams from the equipment manufacturer so as not to delay Project completion.

C. Incorporate complete operating instructions including starting, stopping, and description of emergency manual operation methods for the following:

1. Mechanical Systems.
4. Provide performance curves, charts and diagrams were applicable.
5. Provide operating manual for all equipment listed in individual sections of the specification.

D. Provide maintenance instructions for each item of individual equipment covering pertinent maintenance data, such as lubricants to be used, frequency of lubrication, inspections required, adjustments, belt and pulley sizes, etc.

E. Provide parts bulletins containing manufacturer's bulletins with part numbers, instructions, etc. for each item of equipment. Strip bulletins so that useless bulk is avoided.

F. Post service telephone numbers and/or addresses in an appropriate place as designated by the University Representative.
PART 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 15990 – Plumbing/HVAC Final Testing, Adjusting, and Balancing, to be an inclusive part of his contract documents and shall assume necessary compliance therewith, especially substantial completion. The Contractor shall execute his work in close coordination with the test and balance contractor making every effort to provide complete test and balance systems, responding expeditiously to correct any deficiencies, inadequacies, imbalances, etc. that may be evidenced by the test to those systems. In that regard, cost and labor for the installation, addition, or removal of any shims, sheaves, or other similar items necessary for incremental adjustment of systems or equipment, in order to comply with the requirements to provide complete and balanced
systems demonstrated by test and balance tests, will be considered to be part of the base scope of work of this project.

3.02 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 01780 for requirements.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section.

C. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

3.11 PROJECT RECORD DOCUMENTS

A. Refer to Specification Section 01780 for requirements.

B. Match all symbols and designations used in contract Drawings when preparing "Record" Drawings.

C. Indicate clearly and correctly all work installed differently from that shown, and maintain records up to date as work progresses. Include invert elevations of pipes below grade of floor, the floor lines, plugged wyes, tees, caps, exact locations and sizing of piping, location of valves, and the like. Dimension locations from structural points.

D. Properly identify all stubs for future connections as to locations and use by setting of concrete marker at finished grade in manner suitable to University's Representative.
3.12 PROJECT COMPLETION TESTS AND START-UP:

A. Upon completion of the mechanical work and completion of the BACS point by point verification, or at such time prior to completion as may be determined by the University's Representative, operate and test all mechanical equipment and systems for a period of at least five consecutive 24-hour days to demonstrate the satisfactory overall operation of the building or project as a complete unit. Include operation of heating and air conditioning equipment and systems for a period of not less than five 24-hour days at not less than 90% of full specified heating and cooling capacities in tests. Commence tests after preliminary balancing and adjustments to the equipment and their areas served has been checked. Immediately before starting tests, install air filters and lubricate all running equipment.
Notify the University’s Representative at least seven calendar days in advance of starting the above tests.

B. The Contractor and BACS contractor/vendor will conduct two levels of Quality Assurance to verify that the required installation and performance of the Building Automation Control System as been met.

1. Static Commissioning:
   a. A point-to-point examination and documentation of the successful installation of the BACS system and its components in its entirety.
   b. The start up of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the University.

2. Dynamic Commissioning:
   a. A point-by-point demonstration and documentation of the successful performance of the BACS system and its components in its entirety.
   b. The verification demonstrations of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the University.

C. Provide training and orientation of University's operating staff in proper care and operation of equipment, systems and controls to University's Representative's satisfaction.

D. Neatly tabulate and deliver to the University's Representative complete operational data. Airflows, temperatures, fan speeds, motor currents, static pressures, and other similar data will be supplied by air balance contractor hired by the University.

E. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. All areas of building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

H. Final observation will not be made until all of the above have been completed and balance report has been submitted and reviewed.

I. Provide documentation of all tests as specified by this and other sections. Submit to the University’s Representative in an electronic form (2 copies) and in hard paper form (2 copies). Compile the electronic copies (including graphics or drawings) entirely in the current version of Abode Acrobat complete with an interactive field linked Table of Contents (linked to the chapters and subsections within the report). Submit electronic copies on a CD (or CD's) prior to both Project Close Out AND application for Final Payment. Successful Project Close Out requires receipt and approval of the test documentation.

3.13 POST-CONTRACT COMPLETION TESTS:

A. If the required full-load operation conditions cannot be obtained at the time of the Project Completion Tests due to outdoor seasonal temperatures, return to the job site when
requested by the University's Representative and complete proper loading of equipment and systems as required. Changing of any air filters will not be required under these tests. Contractor will be allowed seven calendar days after notification to begin tests.

3.14 PRE-SEASON START UP:

A. When requested by the University within one year of the filing of Notice of Completion, and when full-load tests required under Project Completion Tests and Post Contract Completion Tests have not been performed, start up any equipment or systems required for heating or cooling season operation by the University when such equipment and systems have remained shut down immediately after the Project Completion Tests. Make proper assurance that all equipment and systems are operating properly before being turned over for the first operational use of the University within one year of filing of Notice of Completion. The changing of any air filters will not be required under these start-up requirements. The Contractor will be allowed seven (7) calendar days after notification, to begin test.

3.15 CLEAN UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, etc., and leave premises clean, neat, and orderly.

END OF SECTION 15010
SECTION 15050
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
9. Excavating and Backfill

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data in accordance with requirements of Specification Section 01330.

B. Equipment Data and Operation and Maintenance Instructions: Submit in accordance with Specification Sections 01780 and 15010 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

A. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type, Weston, Marshal Town, or equal. All thermometers shall be round, stainless steel case construction with glass front and shall be accurate within plus or minus one of the smallest scale divisions throughout the entire range. The thermometer scales shall have a minimum of 2º between graduations and a maximum of 20º between figures. The thermometers shall be located so as to be easily read and shall be furnished with adjustable angle pattern so as to be rotated to any position. Each thermometer shall have ¾” minimum IPS ball valve installed to isolate the thermometer or install thermometer in well.

B. Liquid thermometers for tanks and similar equipment shall have a minimum 5” diameter face. Thermometers for piping shall have a minimum face diameter of 5” and be liquid filled. Thermometers installed on insulated tanks or piping shall be provided with an
extension neck well to compensate for the thickness of the insulation. Thermometers shall be provided with stainless steel stems and steel wells.

C. Thermometers used for air temperature in ductwork, plenum boxes, etc., unless specified or shown otherwise, shall have a minimum scale face of 5” and shall have an adjustable mounting flange so that scale may be set at any angle up to 45° to facilitate reading.

1. The thermometers shall have a perforated guard over stem suitable for sensing air temperature.

2. Length of stem shall be a minimum of 8”.

D. Thermometer wells with chain and cap shall be provided where wells are indicated on the Drawings.

2.04 GAUGES

A. Gauges and gauge connections shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not.

B. Gauges shall be of high quality, with accuracy to be within 1% in the middle third of the dial range and equipped with front calibration. Gauge movements shall be phosphor bronze, bushed, rotary type. Gauges mounted on panel boards shall be the flush-mounting type in cast-iron or aluminum cases. Stem or pipe mounted gauges shall have flangeless cases of drawn or stamped steel, phenolic, or aluminum. Gauges shall have a minimum dial size of 3-½”. Gauges shall be installed with IPS ball valves ¾” or larger S.O.V. for replacement or repair of gauge. Gauge to be installed with a pigtail to minimize gauge fluctuation.
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 ⅜" in height. Plates shall be riveted or bolted to equipment.

D. At completion of project, Contractor shall submit a valve listing for all valves installed on the project. All valves shall be tagged with 2" diameter brass tags noting valve number and contents in the pipe. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted when valve is in the closed position. Separate lists shall be made for the plumbing and mechanical systems. Valve listing sheets shall be 8-½ x 11" installed in a frame with glass cover and suitable for hanging in an area selected by the University’s Representative.

1. Provide Bakelite tags at areas where valves (equipment) are concealed above ceiling or behind access doors. Tags to describe concealed valves (equipment). Color code identification for plumbing shall be blue/HVAC-yellow/Electrical-green/Fire-red.

2.06 ELECTRIC MOTORS

A. Electric motors of more than ½ HP rating shall be, unless otherwise noted, ball-bearing, open (drip-proof), squirrel cage, induction type, normal starting torque, 3-phase, 60-cycle service, 40ºC continuous rating, and shall conform in all respects to latest applicable standards of NEMA and AIEE. Motors shall be Baldor, Century, or equal.

1. Motors located outdoors shall be TEFC type.

B. All motors of 1 HP and above shall be premium efficiency type, Century E-Plus, or equal, no known equal.

C. Motors shall have nameplate voltage rating of operating voltage specified in subsequent sections of specifications or as shown on Drawings and shall have a 1.15 service factor.
D. For normal application, motors shall be furnished for normal starting torque duty. It shall be Contractor's responsibility, however, to provide motors and starters having suitable starting torque and current characteristics to allow starting (where starters are furnished under this section) the equipment within the branch circuit protection provided and within the overload protection required by codes.

E. Splash proof or totally enclosed motors having a continuous-duty temperature rise rating not exceeding 35ºC. shall have adequate starting torque, as recommended by the manufacturer, for the service intended.

F. Shaft Grounding: VFD powered small AC motors (less than 300 hp) shall have a single shaft grounding system to protect the bearings from capacitive discharge through the bearings. The shaft grounding system shall be CR Series as manufactured by Shaft Grounding Systems, Inc., or equal. The shaft grounding system shall reduce the shaft to frame voltage below 3 volts (as measured with Fluke 97 oscilloscope), have low drag, be field installable with hand held tools, sealed to be resistant to weather and contaminants and require no periodic adjustments or maintenance for a normal running life of five years at speed up to 1800 rpm. The grounding brush element must be changeable without shutting the motor down or using special tools. Isolated bearings are an acceptable alternate to shaft grounding.

2.07 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.

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 EXCAVATING AND BACKFILL

A. Excavating required for installation of piping and service lines shall be as specified in Section 02200 and as indicated on Drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping.

B. After pipe lines in excavation have been installed and tested, backfill excavation as specified in Section 02200. Take special care in backfilling over wrapped piping to prevent damage to protective wrapping.
3.02 PAINTING

A. Contractor shall coordinate painting. Exposed piping and unfinished portions of equipment to be painted shall be cleaned of grease, oil, rust, or dirt in preparation for painting.

1. Spot prime all factory-primed surfaces to repair damage to finish.

3.03 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 thrust blocks or equipment bases and foundations in accordance with the requirements specified in Section 03300.

B. Contractor shall coordinate requirements accordingly.

3.04 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.

3.05 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.

3.06 INSTALLATION OF THERMOMETERS

A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb. Pipe sizes at the bulb shall be increased where necessary to allow for full flow without excessive resistance.

B. Where shown on the temperature control diagram, the Contractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers. Duct-mounted thermometers may be omitted at these locations.

C. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as specified below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Range Degrees F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air inlet and outlet of each Bank of heating and cooling coils.</td>
<td>30 to 120°F</td>
</tr>
<tr>
<td>Adjacent to each insertion type thermostat installed (Hot Water) under &quot;Temperature Control.&quot;</td>
<td>+50 to 250°F</td>
</tr>
<tr>
<td>Thermometer bulb to be installed adjacent to bulb (Chilled Water) of insertion thermostat.</td>
<td>+30 to 130°F</td>
</tr>
<tr>
<td>In supply and from tank and return of domestic hot water systems near circulating pump.</td>
<td>30 to 180°F</td>
</tr>
<tr>
<td>In both the water inlet and water outlet of each bank of hot water and chilled water coils and heat exchangers.</td>
<td>+50 to 300°F</td>
</tr>
<tr>
<td></td>
<td>+25 to 125°F (Chilled Water)</td>
</tr>
<tr>
<td>In both the water inlet and water outlet of cooling tower.</td>
<td>+50 to 250°F</td>
</tr>
</tbody>
</table>

D. In such cases where the above described thermometers cannot be located so as to be easily read, a remote reading type of thermometer shall be installed, as approved by the University's Representative.

E. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.07 INSTALLATION OF GAUGES

A. Gauges shall have indication of 0 to 160 psi where indicated pressure will be greater than 40 PSI and 0 to 60 psi for lesser pressures.

B. Provide gauge connections at the following locations:

1. Inlet and outlet of butterfly-type balancing valves.
2. Inlet and outlet of water chiller.
3. Suction and discharge of circulating pump.
4. Elsewhere as may be shown on the Drawings.

C. Gauges shall be provided in a convenient location within approximately 5 feet of the flanges or connections and elsewhere as may be shown on the Drawings.

D. Gauge Cocks and Siphons:
   1. A full port ball valve, or equal, no known equal, shall be supplied at each gauge and gauge connection.
      a. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.08 PIPE IDENTIFICATION

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20-foot developed length intervals on pipe runs.

C. Practical variations or changes in locations and spacing may be made with the specific approval of the University's Representative to meet specific conditions.

D. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

E. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

F. The legends and flow arrows shall be in the colors as indicated in the pipe marking schedule.

G. The paint shall be prepared enamel brushed on or sprayed from pressurized cans.

H. Where the pipe marking colors are not easily visible over the background, such as brown on soil pipe, orange on copper pipe, or similar combinations, a neat white or aluminum-colored background shall be painted on the pipe before the markings are applied.

I. Label and tag valves and piping at access doors.

J. On medical gas, the oxygen piping will be labeled the entire length of the pipe in attics, walls, below floor, etc.

K. Color Coding: All medical oxygen piping shall be labeled every 10' from one end to the other, this includes drops in walls that are sleeved, all overhead piping, etc. All painting shall consist of first quality products. Paint shall be W. P. Fuller, Devoe, or equal. Surface shall be thoroughly cleaned and dry. First coat shall be completely dry before applying second coat.
L. The sizes, in inches, of the stenciled lettering and flow arrows shall be as follows:

<table>
<thead>
<tr>
<th>Outside Diameter, In Inches of Pipe or Covering</th>
<th>Size of Stencil Letter</th>
<th>Minimum Length of Flow Arrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>⅝” to 2” incl.</td>
<td>½”</td>
<td>2-½”</td>
</tr>
<tr>
<td>2-¼” to 4” incl.</td>
<td>1”</td>
<td>4”</td>
</tr>
<tr>
<td>4-½” to 7” incl.</td>
<td>2”</td>
<td>5”</td>
</tr>
<tr>
<td>8” and larger</td>
<td>3”</td>
<td>6”</td>
</tr>
</tbody>
</table>

M. Where different equipment, such as fire sprinklers, are supplied from a common main, such as domestic water, the main should be identified as "Domestic Water" and each respective branch takeoff as "Fire Water," etc.

N. Markers shall be Brady "PIPE MARKERS" color code as per Pipe Markers self sticking Vinyl pipe markers.

Pipe Marking Schedule:

<table>
<thead>
<tr>
<th>Legend</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water</td>
<td>Green</td>
</tr>
<tr>
<td>Hot Water - Domestic Supply</td>
<td>Yellow</td>
</tr>
<tr>
<td>Hot Water - Domestic Return</td>
<td>Yellow</td>
</tr>
<tr>
<td>Hot Water - Heating Supply</td>
<td>Yellow</td>
</tr>
<tr>
<td>Hot Water - Heating Return</td>
<td>Yellow</td>
</tr>
<tr>
<td>Steam Supply (high and low press)</td>
<td>Yellow</td>
</tr>
<tr>
<td>Steam Return</td>
<td>Yellow</td>
</tr>
<tr>
<td>Chilled Water - Supply</td>
<td>Green</td>
</tr>
<tr>
<td>Chilled Water - Return</td>
<td>Green</td>
</tr>
<tr>
<td>Condenser Water - Supply</td>
<td>Green</td>
</tr>
<tr>
<td>Condenser Water - Return</td>
<td>Green</td>
</tr>
<tr>
<td>Gas</td>
<td>Yellow</td>
</tr>
<tr>
<td>Fire - Automatic Sprinklers</td>
<td>Red</td>
</tr>
</tbody>
</table>

3.09 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.

3.10 FLASHINGS

A. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped and sealed above flashing.

3.11 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 15050
PART I - GENERAL

1.01 WORK INCLUDED

A. Types of piping systems and specialties specified in this section include the following:

1. Steel Pipes
2. Copper Tube
3. Cast-Iron Soil Pipes
4. Polypropylene Corrosive Waste Pipe / Fittings
5. PVDF Corrosive Waste Pipe / Fittings
6. Miscellaneous Piping Materials/Products

1.02 QUALITY ASSURANCE

A. Welders' Qualifications:

1. Welding: Qualify welding procedures, welders and operators certified in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping Work.

2. Copper Brazing (including medical gas pipe & fittings):
   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.

C. Installers must possess needed skills and background to successfully install and complete a medical gas-medical vacuum system. Installers of medical gas-medical vacuum piping, fittings, and flexible loops shall be a certified medical gas-medical vacuum installer, current certification required. 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.

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 STEEL PIPES AND PIPE FITTINGS

A. Black Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

1. No galvanized piping, plastic piping, or fittings allowed on potable water in buildings.

C. External corrosion control: buried or submerged pipelines. General Order Code 112D, State PUC Code Subpart 1 -- Requirements for corrosion control 192.455 External protective coating 192.461 cathodic protection required External coating shall be leak detected before covering with fill.

1. At valves, cover pipe flanges, and extend wrap to outer edge of valve flanges or threaded portion of valve body. Cover unwrapped portions of valve body with two
heavy coats of coal tar enamel conforming to AWWA Specification C-203. Allow adequate drying time before backfilling.

D. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above grade only, except where indicated otherwise.

E. Malleable-Iron Threaded Unions: ANSI B16.39; selected by contractor for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze, or brass); plain or galvanized as indicated.

F. Forged-Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

G. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

H. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-½” and where pipe size is less than 1-½”, and do not thread nipples full length (no close-nipples).

2.03 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 ¾” pipe size, unless indicated otherwise on the drawings.

B. DWV Copper Tube: ASTM B 306.

C. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

D. Wrought-Copper Solder Joint Drainage Fittings: ANSI B16.29.

E. Medical gas copper piping shall be hard-drawn seamless medical gas tube, type K or L (ASTM B819), and bear one of the following markings: OXY, MED, OXY/MED, ACR/OXY, or ACR/MED. Mains and branches in piping systems shall be not less than ½” nominal size. Runouts to area alarm panels shall be permitted to be ¼” nominal size. All medical gas-medical vacuum pipes and fittings to be ACR cleaned and bagged when received at project site. All medical gas-medical vacuum pipes to be factory capped (sealed) when
received at project site. These materials shall be protected from adverse weather and site conditions at all times.

F. All medical oxygen and medical nitrous oxide pipe shall be protected in conduit sleeves when installed in walls.

G. Medical gas zone valves to be located outside of Operating Rooms.

H. All shutoff valves to be located outside of patient rooms and critical rooms.

2.04 CAST-IRON SOIL PIPE AND PIPE FITTINGS

A. Hubless Cast-Iron Soil Pipe: AB&I, Tyler, Charlett or equal.

B. Cast-Iron Hub-and Spigot Soil Pipe: Cast iron soil pipe and fittings shall conform to the requirements of CISPI Standard 301, ATSM A-888 or ASTM A-74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of engineer.

C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel four band no hub Husky or equal clamp band, for above grade installation only.

1. Cast iron waste lines below ground, below floor, in walls and in ceilings to be stainless steel four band no hub Husky 4000 bands. Standard stainless steel two band no hub bands to be used on vent systems only, no exceptions taken.

D. Cast-Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards, ASTM A 74.

E. Compression Gaskets: ASTM C 564.

F. Lead/Oakum Joint Materials: Provide products complying with governing regulations for use in service indicated.

2.05 POLYPROPYLENE CORROSIVE WASTE PIPE AND FITTINGS

A. Pipe: Fire Retardant

Pipe shall be manufactured to Schedule ____ (40 or 80) polypropylene pipe dimensions and tolerances per ASTM F-1412. Pipe to be supplied in 10-foot lengths and manufactured with a chemically resistant and fire retardant polypropylene material conforming to ASTM D-4101. Zurn or equal.

B. Pipe: Non-Flame Retardant

Pipe shall be manufactured to Schedule ____ (40 or 80) polypropylene pipe dimensions and tolerances per ASTM F-1412. Pipe to be supplied in ____ (10 or 20) foot lengths and
manufactured with a chemically resistant polypropylene material conforming to ASTM D-4101. Zurn or equal.

C. Fittings: Fire Retardant

Fittings shall be manufactured to Schedule 40 polypropylene pipe dimensions of a chemically resistant and fire retardant polypropylene material conforming to ASTM D-4101. Fittings to conform to applicable tolerances in ASTM F-1412. Zurn or equal.

D. Joints

Pipe and fittings are joined by either heat fusion or by using mechanical joints. Zurn patented fittings accept either joining method.

1. Mechanical: Pipe and fittings shall be joined by the use of a mechanical seal that has a chemical resistance equal to the pipe and fittings. The mechanical joint system shall incorporate a positive mechanical system (groove) for axial restraint.

2. Electrofusion: Pipe and fittings shall be joined by the use of a fusion joining machine.

2.06 PVDF CORROSIVE WASTE PIPE AND FITTINGS

A. Pipe: Fire Retardant

Pipe shall be manufactured to Schedule ____ (40 or 80) pipe dimensions and tolerances per ASTM F-1673. Pipe to be supplied in 10-foot lengths and manufactured with a chemically resistant PVDF material conforming to ASTM D-3222. The PVDF material shall meet UL-723 requirements for flame spread rating less than 25 and smoke developed less than 50. Zurn or equal.

B. Fittings: Fire Retardant

Pipe and fittings are joined by either heat fusion or by using mechanical joints. Zurn or equal.
1. Mechanical: Pipe and fittings shall be joined by the use of a mechanical seal that has a chemical resistance similar to the pipe and fittings. The mechanical joint system shall incorporate a positive mechanical system (groove) for axial restraint.

2. Electrofusion: Pipe and fittings shall be joined by the use of a fusion joining machine.

2.07 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 \( \frac{3}{4} \)" 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. Grade water circulating piping used for space heating and/or cooling up to high points at the rate of \( \frac{3}{4} \)" in 10' in the direction of flow with returns grading down at same rate. Air
vent valves specified hereinafter shall be installed at high points. Changes in pipe sizes shall be made with eccentric reducers flat on top.

O. Condensate Drain Piping: Run piping with pitch as shown, without pockets.

P. 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 3½" shall be a 1½" low point drains and 1½ 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 240º heating hot water systems.

Q. 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 PROTECTIVE PIPE WRAP

A. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material. Use leak detector to locate breaks in pipe insulation - then repair.

3.03 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.

3.04 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Cut all steel pipe and hard copper tubing by power hacksaw, a circular cutting machine using an abrasive wheel or in square end vise by means of hand hacksaw. Wheel cutters may be used for steel pipe provided that pipe shall have ends reamed to full inside diameter and beveled before being made up into fittings. Pipe shall have round edges or burrs removed so that a smooth and unobstructed flow will be obtained.

C. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, Rector-Seal #5, or equal, on male threads at each joint and tighten joint to
leave not more than 3 threads exposed. Teflon tape may be used on piping smaller than 2”.

D. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.

E. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.

F. 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.

G. 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, pete's 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.

H. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31-1 and B-31-1A.
2. Bevel pipe ends at a 37.5º angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.

I. Install forged branch-connection fittings wherever branch pipe of two pipe sizes smaller than main pipe is indicated; or install regular "T" fitting.

J. Flanged Joints: Match flanges within piping system and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

K. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions and in accordance with CISPI Pamphlet No. 100, latest edition.

1. Cast iron waste lines below ground, below floor, and in ceilings to be stainless steel four band no-hub Husky bands minimum as required by pipe size, or equal. Standard stainless steel two band no-hub bands to be used on vent systems only.
2. Make joints between cast-iron and steel pipe same as above with special adapter as required.

3.05 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.

<table>
<thead>
<tr>
<th>SYSTEM TESTED</th>
<th>TEST PRESSURE PSIG</th>
<th>TEST WITH</th>
</tr>
</thead>
<tbody>
<tr>
<td>All soil, waste drain &amp; vent piping; all storm drains within buildings minimum height of standpipe shall be 10 feet above piping being tested.</td>
<td>Before backfilling fill with water to top of highest vent, allow to stand 2 hrs. or longer as directed by inspector.</td>
<td>Water</td>
</tr>
<tr>
<td>Hot and chilled water distribution system connections.</td>
<td>225 lbs.</td>
<td>Water</td>
</tr>
<tr>
<td>Hot and cold water piping (heating &amp; plumbing)</td>
<td>150 lbs. rough-in. 150 lbs. after equipment connection.</td>
<td>Water</td>
</tr>
<tr>
<td>Low pressure steam and condensate</td>
<td>150 lbs.</td>
<td>Water</td>
</tr>
<tr>
<td>High pressure steam</td>
<td>50% above design operating pressure</td>
<td>Water</td>
</tr>
<tr>
<td>Fire sprinkler piping</td>
<td>200 lbs.</td>
<td>Water</td>
</tr>
</tbody>
</table>

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.

3.06 CLEANING OF HYDRONIC PIPING SYSTEMS AND EQUIPMENT

A. Steam, chilled, heating systems shall be cleaned and flushed as follows:

<table>
<thead>
<tr>
<th>Detergent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soda Ash</td>
<td>41%</td>
</tr>
<tr>
<td>Sodium Silicate Pontahydrate</td>
<td>34%</td>
</tr>
<tr>
<td>Sodium Tri-Polyphosphate</td>
<td>24%</td>
</tr>
<tr>
<td>Wetting Agent, Non-Toxic</td>
<td>1%</td>
</tr>
<tr>
<td>Non-Foaming</td>
<td></td>
</tr>
</tbody>
</table>

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.

3.07 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
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
   Globe Valves (Steam Only)
   Cocks (Natural Gas only)
   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.


2.03 PIPE SLEEVES

A. Where pipes pass through concrete floors or walls, install galvanized metal or plastic sleeves having not less than ½" 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 safing.

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:

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Union</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel pipelines, 2&quot; and smaller</td>
<td>250 lb. screwed malleable ground joint, brass to iron seat, black for black pipelines, galvanized for galvanized lines.</td>
</tr>
<tr>
<td>Copper tubing, 1-¼&quot; and smaller</td>
<td>250 lb. bronze ground joint, bronze to bronze sweat connection.</td>
</tr>
<tr>
<td>Copper tubing, 1-½&quot; and larger</td>
<td>250 lb. cast bronze, flat faced flange with silver brazing threadless ends.</td>
</tr>
</tbody>
</table>

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. Furnish and install flanges at each flanged connection to equipment, tanks, and valves per following schedule:

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Flanges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwed black steel pipelines, 2-½” and larger.</td>
<td>125 lb. cast-iron screwed flange flat faced black.</td>
</tr>
<tr>
<td>Welded steel pipe, 2-½” and larger.</td>
<td>150 lb. forged steel welding flanges, ⅛” raised faced, unless noted otherwise.</td>
</tr>
</tbody>
</table>

D. Provide full faced or ring type gasket material to suit facing on flanges per following schedule:

<table>
<thead>
<tr>
<th>Service</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water</td>
<td>⅛” thick rubber Garlock #22, or equal, no known equal.</td>
</tr>
<tr>
<td>Hot Water</td>
<td>⅛” thick Flexatulaic gasket, or equal, no known equal.</td>
</tr>
<tr>
<td>Steam</td>
<td>⅛” thick Flexatalic, or equal, no known equal.</td>
</tr>
<tr>
<td>Gas</td>
<td>⅛” thick Garlock #7986, or equal, no known equal.</td>
</tr>
</tbody>
</table>

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 ½” full port IPS. All with ¾” 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.


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 ⅜” to 2” shall be ball valves; size 2-½ and larger shall be butterfly.

C. Four-inch and larger gate, Globe or O S & Y valves located 10 feet or higher above floor shall be provided with chain operators.

D. Balancing Valves shall provide multi-turn, 360º 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.

E. 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.

F. 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.

G. Shut off valves located in ceilings, walls, and floors shall bee accessible through access doors or ceiling lift out tiles (finished ceiling). Valve handles shall be located within 24” of access door.

H. 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 ½” - 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 ½” in size with ¾” 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. Temperature-or pressure-regulating valves
6. 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 15100
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
   d. Steam and Condensate
   e. Chilled Water
   f. Storm Drains

2. Ductwork System Insulation:
   a. Supply Ducts
   b. Return Ducts

3. Equipment Insulation:
   a. Backflow Device (exposed to elements)
   b. Chilling Equipment
   c. 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 01330. 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 01780 and 15010 requirements.

PART II - PRODUCTS

2.01 PIPE INSULATION MATERIALS:

A. Calcium Silicate:

1. Hydrous calcium silicate material recommended for temperatures up to 1200°F. Applied per manufacturer's recommendations.

2. Cover insulation with aluminum jacket. Apply jacket to insulated surfaces per manufacturer's recommendation. Provide pre-molded insulation covering on fittings.

3. After test, insulate all fittings, valves, bonnets, strainers, etc. to a thickness equal to the adjacent piping insulation. For copper pipe trim insulation as required to suit copper line outside diameters.

4. Manufacturers: Calsilite Insulation Products, Pabco Super Caltemp, or equal

B. 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 2-½" 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.


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: ¾".

2. Piping 2-½" 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 2-½” and larger: 1-½”.

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 Skal + 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: 1-½”.
   2. Piping 2-½” 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 STEAM AND CONDENSATE

A. Insulate steam and condensate piping with calcium silicate or high temperature mineral fiber insulation per manufacturer’s recommendation.

B. Minimum Insulation Thickness:

1. Piping 1” and smaller: 2”.
2. Piping 1-¼” to 2”: 2”.
3. Piping 2-½” to 4”: 2-½”.
4. Piping 5” and larger: 3-½”.

C. Valves and Fittings

1. Insulate all valves, unions, Victaulic couplings, and other components in steam 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.
2.06 CHILLED WATER

A. Insulate exposed and concealed chilled water supply and return piping with 4 lb. nominal density fiberglass insulation.

B. Minimum Insulation Thickness:
   1. Piping 1” and smaller: 1”.
   2. Piping 1-¼” and larger: 1-½”.

C. Valves and Fittings
   1. Insulate all valves, unions, Victaulic couplings, and other components in chilled water systems with pre-molded removable (replaceable) 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 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.

2.07 DUCTWORK

A. All ductwork insulation to be exterior only. Wrap all supply and return ductwork and sound traps, unless indicated or specified otherwise, with 1-½” 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.
2.08 BACKFLOW DEVICES (exposed to elements)

A. On exterior Backflow Assemblies Insulating Pad

B. Insulation - 2" TIW fiberglass blanket

C. Jacketing - Silicone glass cloth (15 oz minimum -both sides with silicone)

D. Lacing Hooks - Stainless steel

E. Lacing Wire - Stainless steel

F. Pad seam attachment - Sewn with glass thread only, or equal, no known equal.

G. Execution: Both the interior and exterior of the pad shall be silicon glass cloth. The pad is to be custom fit tight to the backflow preventor. Toaster cover design is not acceptable. Construct pad with seam at bottom to allow drainage.

2.09 CHILLING EQUIPMENT

A. Insulate water-chilling equipment, including chilled water pump bodies, air separators, chillers, expansion tanks, etc., operating at reduced surface temperatures and which do not have factory-applied, low-temperature insulation.

B. Insulation shall be 3" thick, 3-lb. density fiberglass board.

C. Apply a 1-½" galvanized hexagonal mesh netting, stretched tight and securely fastened to the insulation, and cover with two coats of hard finish insulating cement to a total minimum thickness of ½”. Leave the first coat with a rough surface and allow to dry before the second coat is applied. Trowel the second coat smooth, and finish with 8-ounce canvas jacket, tightly pasted on with lagging adhesive.

D. Provide a light coat of dilute adhesive followed by two heavy coats of Fosters 30-36, or equal, no known equal, vapor barrier coating at the rate of 50 square feet per gallon. After this sealant has dried, apply Foster 30-35, or equal, no known equal, vapor barrier coating at the rate of 50 square feet per gallon.

E. Manufacturers: CertainTeed Corporation, Johns-Manville Corporation, Owens-Corning Fiberglas Corporation, or equal.

2.10 HEATING EQUIPMENT

A. Cover the hot water equipment including heat exchangers, air separators, etc. with 3" calcium silicate or high temperature mineral fiber blocks, securely wired on.

B. Apply a 1-½” galvanized hexagonal mesh with two coats of hard-finish, all-purpose cement to a total minimum thickness of ½”. The first coat shall be left with a rough surface and
allowed to dry before the second coat is applied. The second coat shall be troweled smooth and finished with 8-ounce canvas jacket, tightly pasted on with lagging adhesive.

C. The entire surface of the canvas jacket shall have a finish sizing consisting of one brush coat of dilute adhesive.

D. Do not insulate expansion tanks and hot water pump casings.

E. Manufacturers: CertainTeed Corporation, Johns-Manville Corporation, Owens-Corning Fiberglas Corporation, or equal.

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.

3.03 INSTALLATION OF EQUIPMENT INSULATION

A. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

B. Do not apply insulation to equipment, while hot.

C. Do not insulate ASME stamps, or manufacturer’s nameplate. Provide neatly beveled edge at interruptions of insulation.

END OF SECTION 15250
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:

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.


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 01770 Closeout Procedures and 01780 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:


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 BACKFLOW PREVENTERS
   A. Backflow Devices: Ames, Wilkins or equal. Pressure loss is a major concern at University. All exterior backflow devices shall be installed above grade. Must be a listed indicating type
valve in accordance with NFPA 24, 1998 edition or latest edition adopted by authority having jurisdiction. All valves must be monitored by the building’s fire alarm system.

1. Installed according to A.W.W.A. Standards and Specs, 9th Edition.
2. Installed and tested according to CPC - 2001 Edition.
3. CA Code of Regulations, Title 17 - Public Health.
4. CA Code of Regulations, Title 24 Part 5 Plumbing Code.
5. Strainers upstream of devices w/union, w/minimum ¾” blowdown ball valve.
6. Install no higher than 5' above finished floor, 12" min. From floor, 12” minimum from wall.
7. Insulate all exterior devices.
8. Backflow devices at service connections to buildings, backflow devices at equipment for makeup water, shall be provided with a bypass (parallel) having a matching type of backflow device (same size, model). This bypass shall allow for testing and repairs of the backflow devices while preventing the interruption of service to building or equipment.
9. All backflow assemblies on new installations, retrofits, relocated assemblies, or repaired assemblies shall be tested when they are put back into service.

2.08 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.

Stockham Valves and Fittings., Western Fire Equipment Company; Division of Premier Industrial, or equal.

2.09 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.

2.10 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.


2.11 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.


2.12 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.


2.13 FIRE PUMP

A. Furnish and install, where shown on Drawings, fire pump and jockey pump, and all accessories required for a complete, approved system.

B. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65% of rated head. The shut-off pressure should not exceed 140% of the rated pressure. The pump unit shall meet all requirements of NFPA #20, 1999 edition or latest edition as approved by authority having jurisdiction and shall be UL listed and CSFM approved. Pump and driver shall be mounted on a common baseplate and direct connected through a flexible coupling. Unit shall include a coupling guard. The following accessories shall be included with the pump unit:

1. Eccentric reducers or enlargers as required.

2. Suction and discharge gauges.

3. Automatic air release valves.

4. ¾" casing relief valve.

5. Test header.

C. Driver shall be an electric motor of the ODP type, wound for 460 volts, 3 phase, 60 cycle current. Locked rotor current shall not exceed the values specified in NFPA #20, 1999 edition or latest edition adopted by authority having jurisdiction. Bearing shall be anti-friction ball or roller type.

D. The motor control equipment shall be complete assembled, wired, and tested at the factory, and the assembly shall be specifically UL approved for fire pump purposes. The controller shall be marked "FIRE PUMP CONTROLLER". All equipment shall be enclosed in an
approved driptight enclosure. Controller shall be of the combined manual and automatic across-the-line type incorporating the following:

1. Disconnect switch - externally operable, quick-break type.
2. Circuit breaker - time delay type with trips in all phases, set for 300% of motor full load current. Interrupting capacity of circuit breaker shall be 100,000 amperes (RMS).
3. Motor starter - across-the-line capable of being energized automatically through the pressure switch or manually by means of an externally operable handle.
4. Pressure switch - set to start pump at drop in pressure. Panel shall have automatic stop.
5. Pilot lamp - to indicate circuit breaker closed and power available.
8. Two sets of dry contacts for remote indication of power failure and pump running. Provide bypass for generator start circuit at fire pump controller. Provide monitoring by fire alarm system.
9. In addition to the items specified above, control panel shall include an automatic transfer switch for transfer from building standard power to emergency power and vice versa. Three-phase voltage is monitored on Normal Source and a transfer to the Emergency Source is initiated by loss of any phase or reduction in voltage below a predetermined value. Single phase is monitored on Emergency Source which verifies the emergency voltage and frequency is at a predetermined value before permitting a transfer to Emergency Source. Power for the drive motor mechanism is taken either from the normal or emergency source as required.

10. Time delays shall be provided to:
   a. Override momentary voltage drops on Normal Source.
   b. Prevent transfer back to Normal Source to allow for stabilization of Normal Source. If Emergency Source fails during this time delay period, the delay is overridden and the transfer is initiated.
   c. Allow engine (emergency source engine generator set) to run unloaded to cool down after transfer to Normal Source is completed.

11. Transfer switch to be an integral part of control panel and to include all interconnecting wiring. Complete assembly to have UL label.

2.14 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.

2.15 VENTURE LOOP

A. Fire pump shall have a closed loop for testing, including a 5" Venturi and wall mounted meter reading directly in GPM.

2.16 JOCKEY PUMP

A. Furnish and install, where shown on Drawings, jockey pump assembly complete with all accessories. Pump shall have a capacity of 10 GPM at 125 PSI and driven by a 2 HP, 460 volt, 3500 RPM motor.

B. Jockey pump control equipment shall be completely assembled, wired, and tested at the factory. Controller shall be marked "FIRE JOCKEY PUMP CONTROLLER". All equipment shall be enclosed in one or more approved drip-tight enclosures. Controller shall be PERLESS Model FTA500 or LEXINGTON Model LX-600 of the combined manual and automatic type incorporating the following:

1. Externally operable fusible disconnect switch.
3. Three-position pilot switch - "MANUAL-OFF-AUTOMATIC".
4. Mercoid pressure regulator with adjustable cut-in and cut-out pressure points which control the automatic operation of the pump.
5. Minimum running period timer.

2.17 UNIT PACKAGE

A. The pumps, motors, all controls, and necessary attachments, specified herein, shall be purchased under a unit Contract. The pump manufacturer shall assume unit responsibility and shall provide the services of a qualified engineer to supervise the installation of equipment, check coupling alignment, and be available to conduct final acceptance test along with Underwriting authorities. Contractor shall include these services in bid.
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 ¾” 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 15300
PART I - GENERAL

1.01 WORK INCLUDED
A. Types of plumbing piping systems specified in this section include the following:
   1. Water Piping
   2. Building Drain Piping
   3. Rainwater Piping
   4. Storm Drain Piping
   5. Vent Piping
   6. Piping Specialties
   7. Valves
   8. Cleanouts
   9. Floor Drains
  10. Roof Drains
  11. Trap Primers
  12. Hose Bibbs
  13. Wall Hydrants
  14. Backflow Preventors

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.
      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 with 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 1-¼" and Smaller: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder joints.
   b. Tube Size 1-½" and Larger: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, brazed joints. This includes all pressure systems, all brazing by certified brazers only.
   c. All heating water copper pipe joints shall be brazed.
   d. Rubber gaskets shall NOT be used in any domestic water system.

2. Exterior Water Piping:
   a. Pipe Size 4" through 12" Below Grade: Polyvinyl chloride (PVC) water pipe; Class 150, DR-18; cast-iron or ductile-iron fittings, ring-tite joints. Pipe shall be listed as AWWA C900.

3. Above Ground Building Drain Piping:
   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.

4. Vent Piping:
   a. Sizes 2-½" 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.

5. Underground Building Drain Piping:


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.

6. Above Ground Rainwater Piping:


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 minimum as required by pipe size, to match campus standard. Standard stainless steel four band no-hub bands to be used on waste and vent systems.

c. Galvanized steel pipe; schedule 40; class 125, black cast-iron fittings, drainage pattern, screwed joints.

7. Underground Storm Drain Piping:


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.

4. Check Valves:
   a. All Sizes: Swing check valves or in-line spring loaded check valves.

5. Balance Valves:
   a. Balancing valves to be Armstrong, Tour Anderson, or equal. Valve 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. Plug design valves are not acceptable. 90° turn adjustable valves are not acceptable.

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 WALL HYDRANTS

A. Recessed Wall Hydrants: Cast-bronze box hydrant, nickel bronze face, tee handle key, bronze casing, length to suit wall thickness, hinged locking cover, 3/4-inch inlet, hose outlet with non-removable vacuum breaker.

B. Manufacturer: Smith (Jay R.) Manufacturing Company, Josam Manufacturing Company, Zurn Industries Inc., Hydro mechanics Division, or equal.

2.06 BACKFLOW PREVENTERS

A. Provide reduced-pressure principle backflow preventers consisting of assembly, including shutoff valves on inlet and outlet, and strainer on inlet, Ames, Wilkins, or equal, no known equal. Backflow preventers shall include test cocks, and pressure-differential relief valve located between two positive seating check valves. Construct in accordance with ASSE Standard 1013.

1. Install according to A.W.W.A. standards & Specs, 9th Edition.

2. Install and test according to UPC 1994 Edition.

3. CA Code of Regulations, Title 17-Public Health.

4. CA Code of Regulations, Title 24-Plumbing Code.

5. Strainers upstream of devices w/union, w/minimum ¾” blowdown ball valve.

6. Install no higher than 5' above finished floor, 12" min, from floor, 12" min from wall.

7. Insulate all exterior devices.

8. Backflow devices at service connection to buildings, backflow devices at equipment for makeup water, shall be provided with bypass (parallel) having a matching type of backflow device (same size, model). This bypass shall allow for
testing and repairs of the backflow devices while preventing the interruption of service to building or equipment.

9. All backflow assemblies on new installations, retrofits, relocated assemblies, or repaired assemblies shall be tested when they are put back into service.

10. All backflow assemblies that are installed outdoors shall have B.F. Blanket and have pull down access for testing.

B. Manufacturer: Ames, Wilkins, or equal.

2.07 RELIEF VALVES

A. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210º F, and pressure relief at 150 psi. Rating shall be in accordance with AGA listing.

C. Manufacturer: Watts Regulator Company, Cash (A.W.) Valve Manufacturing Corporation, Zurn Industries, Inc., Wilkins-Regulator Division, or equal.

2.08 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.
2.09 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.

2.10 FLOOR DRAINS

A. Provide floor drains of size as indicated on Drawings, and type, including features, as specified herein, or equal, no known equal. Provide flashing ring and clamp at floors with
waterproofing membrane. Set top of drain slightly below floor to insure drainage. Install vented P-trap below each drain.

1. General Service Floor Drains: Zurn ZN-415-B, Smith, or equal.
2. General Service Floor Drains: Zurn ZN-415-S, Smith, or equal. (ceramic tile floors)
3. Floor Drains in Mechanical Rooms: Zurn Z-550 with C.I Bucket, Smith, or equal.
4. Area Drains: Zurn Z-550-Y (C.I.), Smith, or equal.
5. Floor Sinks in Mechanical Areas: Zurn Z-611 half grate, Smith, or equal.
6. Floor Sinks in Boiler Room: Zurn Z-543, Smith, or equal.

B. Floor drains: Zurn, J. R. Smith, or equal.

2.11 ROOF DRAINS

A. Provide roof drains and overflow roof drains of size as indicated on Drawings, and type, including features, as specified herein. Locate roof drains per architectural roof plans. All roof drain domes shall be cast-iron. Roof drains shall be cast iron also. Roof drains and overflow drains, install gravel stops to keep roof gravel at least 24" from edge of drain to edge of the gravel stop in all directions.

1. Roof Drains (membrane roofs): Zurn ZC-100-DP (-E where necessary) with C.I. Dome, Smith, or equal.
2. Overflow Roof Drains: Zurn ZC-100-DP-89 (-E where necessary) with C.I. dome and 2" high water level regulator, Smith, or equal.
3. Deck Drains: Zurn Z-415-BL, with extension adaptor where required for proper elevation, Smith, or equal.
4. Scupper Drains: Zurn Z-177-VP, Smith, or equal.

B. Manufacturers: Zurn, J. R. 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 ¼” 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 ¼” 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 45º 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 ¾” 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 ROOF DRAINS

A. Install roof drains and overflow roof drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

C. At gravel-surfaced roofs, hold gravel minimum 24" from center of drain and overflow drain to edge of stop, in all directions.

D. Storm drains and overflow piping inside of the building envelope shall be insulated.

3.06 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
3.07 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated on Drawings. Where drain pans are shown on the Drawings, pipe drain pan outlet to nearest floor drain.

B. Install per Chapter 6, uniform plumbing code.

C. All new BF Preventers shall be tested and certified.

3.08 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.

3.09 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

1. All plumbing fixtures with hot water to be connected to a hot water return system.

2. Hot water return connections at fixtures shall be made within 6’ developed length of the fixture or equipment.

3. Supply water piping to fixtures & equipment shall be a minimum of ¾” pipe size, no ½” piping allowed.

3.10 SPARE PARTS

A. Furnish to University, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

3.11 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 15400
SECTION 15440
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. Urinals
3. Lavatories
4. Mop Sink
5. Sinks
6. 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 ¾” 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. Wall mounted urinals
2. 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-5610 1.6 GFP Wall Hung Topspud Flushvalve Bowl with Zurn Z-6000AV-WS-1 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. Urinal (UR-1): Zurn Z-5730 1.0 GFP with Zurn Z-6003AV-WS1 flush valve containing a TPE chloramine resistant filtering diaphragm or equal.

E. Urinal (UR-2): Zurn Z-5730 1.0 GFP with Zurn Z-6003AV-WS1 flush valve containing a TPE chloramine resistant filtering diaphragm or equal (mount at handicapped height).

F. Lavatory (L-1): Zurn Z-5220 19 x 16 Under Mount vitreous china lavatory with Zurn Z-8100 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.

G. Lavatory (L-2): Zurn Z-5344 20 x 18 4" CC vitreous china lavatory for concealed arm support (Zurn Z-1231), Zurn Z-8100 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.

H. Mop Sink (MS): Terrazzo TDF-24, TCR-28, or Kohler K-6710, or equal with Zurn Z-843M1-CS-WHK-5H or equal with vacuum breaker, wall support, integral check stops, 5’ hose and hose bracket mounted with stainless steel screws. Mount faucet at +36°.

I. Sink (S-1): Eljer or Elkay 21 x 22 with 6 ½” depth, three-hole drilling, self-rimming construction, No. J 35 crumb cup strainer, Chicago No. 1100 modified with GN-2A-E3 gooseneck faucet, Zurn ZTT461 3-½” cup strainer, Zurn Z-871-B1-4F gooseneck faucet with ceramic disk cartridges, or equal. Provide 1-½” diameter hole for soap dispenser in location shown on Drawings. Where sink is used for handicapped provide 7723.018 (Zurn Z-8739) grid drain with offset and insulate hot water and drain piping exposed below sink as required in mechanical insulation section.

J. Sink (S-2): Eljer or Elkay 18 x 15 with 6 ½” depth, three-hole drilling, self-rimming construction, No. J-35 crumb cup strainer, Chicago No. 1100 modified with GN-2A-E3 gooseneck faucet, Zurn ZTT461 3-½” cup strainer, Zurn Z-871-B1-4F gooseneck faucet with ceramic disk cartridges, or equal. Provide 1-½” diameter hole for soap dispenser in location shown on Drawings. Where sink is used for handicapped provide 7723.018 grid drain with offset and insulate hot water and drain piping exposed below sink as required in mechanical insulation section.

K. Sink (S-3): Eljer or Elkay 22 x 33 with three hole drilling, self-rimming construction, No. J-35 crumb cup strainer, Chicago No. 1100 modified with GN-2A-E3 gooseneck faucet, Zurn ZTT461 3-½” cup strainer, Zurn Z-871-B1-4F gooseneck faucet with ceramic disk cartridges, or equal. Provide 1-½” diameter hole for soap dispenser in location shown on Drawings.

L. Electric water cooler (EWC-1): Haws Model 1108 with stainless steel finish and vandal-resistant stainless steel bottom plates, or equal, no known equal. Package shall include Haws Model HCR8 remote Chiller, or equal, no known equal. Chiller shall provide 8.0 gallons per hour of 50°F water, with inlet water temperature of 80°F and ambient temperature of 90°F. Compressor shall be 1/5 HP air cooled, 115-volt. Provide terminal enclosure for power supply. Mount bubblers at heights indicated on Drawings.

M. Electric Water Cooler (EWC-2): Haws Model HWCD8-2 with stainless steel cabinet and vandal-resistant stainless steel bottom plates, or equal, no known equal. The unit shall provide 8.0 gallons per hour of 50°F water, with inlet water temperature of 80°F and ambient temperature of 90°F. Compressor shall be 1/5 Hp, air-cooled, 115-volt. Provide terminal enclosure for power supply, and mount unit with bubblers at heights indicated on Drawings.

N. 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).

O. 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.

P. 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 11610 for additional information.

B. EMERGENCY EYE/FACE 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 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.
C. EMERGENCY EYE WASH AND SHOWER

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 1-1/4 inch.

3. Installed so that the shower head is not less than 82 inches or more than 96 inches from the surface on which the user stands.

4. Shower component activated yearly to verify proper operation.

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 15440
PART I - GENERAL

1.01 WORK INCLUDED

A. Types of plumbing equipment required for project include the following:

1. Domestic Hot Water Heat Exchanger
2. Domestic Water Booster Pump
3. Hydro pneumatic Storage Tank
4. Domestic Hot Water Recirculation Pumps
5. Potable Water Treatment
6. Temperature Mixing Valve
7. Thermal Expansion Tank

1.02 NOT USED

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein.

C. Dimensions, sizes, and capacities shown are minimums and shall not be changed without permission of University's Representative.

D. UL and NEMA Compliance: Provide electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

E. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

F. Workmanship: Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or 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 plumbing equipment specifications, installation and start-up instructions, capacity and ratings, with selection points clearly indicated.

B. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include troubleshooting maintenance guides. Include this data in maintenance manual.

PART II - MATERIALS

2.01 DOMESTIC HOT WATER HEAT EXCHANGER

A. Furnish and install double wall domestic hot water heaters of model and in location as shown on drawings. Each heater shall be of the vertical double wall coil design with service water in the shell and hot water in the coils. An integral internal controller shall be provided which anticipates a change in demand so that the final temperature can be maintained to +/- 4 Deg. F under all normal load conditions when used in conjunction with a self-contained control system.

B. Certification of the unit as to design and manufacture in accordance with ASME Pressure Vessel Code, Section VIII, shall be furnished for not less than 160 psig maximum allowable working pressure in the shell and not less than 250 psig maximum allowable working pressure in the tubes.

C. Shall be carbon steel and copper lining. Upper head shall be cast bronze.

D. Shall be of helical wound design with automatic de-scaling. No water baffles shall be used within coils.

E. Each heater shall be furnished with the following standard accessories:

1. Resilient insulation exceeding the ASTM E84 fire and smoke rating.

2. Self-contained two way control valve with temperature controller. No three way control valves.

3. Temperature/pressure relief valve.

4. Union orifice and check valve.

5. Fully wired control box, featuring:
   a. Double solenoid temperature limit system
   b. Power on/tripped status lights
   c. Remote dial thermometer(s) and/or compound gage.

F. Manufacturers: CemLine, PVI Industries, A.O Smith or equal.

2.02 DOMESTIC WATER BOOSTER PUMP SYSTEM
A. Provide duplex water booster system with each pump sized for 100% of the total system flow.

B. System shall be factory assembled with total system capacity as required. The unit shall be completely factory assembled and tested and shall utilize stainless steel suction and discharge manifolds. Suction and discharge manifold pressure gauges shall be included.

C. The system shall include bronze fitted end suction, close coupled centrifugal pumps. Suction and discharge isolation valves and a non-slam check valve for each pump shall be furnished so that individual pumps may be serviced with the booster system in operation. Pump sequencing shall be controlled by a single flow sensor in a common housing, providing direct visual indication of the flow rate. This device shall include necessary pump sequencing switches and shall be so constructed as to select the smallest pump-horsepower combination to satisfy all conditions of system flow demand. The flow sensing device shall be readily field adjustable from a single location. Each system shall also be furnished with a thermal purge valve system to protect pumps.

D. Control Panel: Each system shall include a UL labeled control panel in a NEMA (1) Enclosure. Panel shall include an externally operable main disconnect, individual motor circuit breakers, fused control power transformer, door interlock, H.O.A., magnetic starters with 3 leg overload protection and externally operable reset buttons. The control panel shall also include motor running lights, power on light, minimum failure protection, and audible alarm package. Duplex unit will have manual alternator. The controller shall also be furnished with low suction pressure shut-off, no flow shut-off, and automatic 24 hour alternator of Duplex.

E. Motors: Motors shall be close-coupled drip proof type. Main pump motors shall be as required per design.

F. Tank: One 80 gallon, bladder type, Hydro pneumatic pressure tank designed to ASME code and stamped 175 PSI working pressure shall be furnished mounted and piped at the factory. Bladder shall be made of Butyl rubber and be FDA approved for domestic water application.

G. A pilot operated combination pressure regulating valve shall be furnished for each pump and shall be shipped loose for field installation.

H. The entire unit shall be factory assembled and tested. System shall be cleaned and painted with high grade machine enamel prior to shipment and include field start-up.

I. Manufacturers: Bell & Gossett ITT, Aurora, PACO Pumps, or equal.

2.03 HYDROPNEUMATIC TANK

A. Non-ASME, pre-pressurized tank. Steel shell, malleable iron system connection with Butyl diaphragm and polypropylene liner. Maximum design pressure equals 150 psig. Maximum design temperature equals 200°F.

B. Manufacturers: Bell & Gossett ITT or equal.
2.04 EXPANSION TANK
   A. ASME, pre-charged diaphragm tank. Maximum working pressure equals 125 psi. Maximum operating temperature equals 240°F. Provide California site glass.
   B. Carbon steel shell; heavy duty butyl rubber diaphragm; forged steel system connection.
   C. Manufacturers: Amtrol or equal.

2.05 POTABLE WATER TREATMENT
   A. Install as scheduled where shown on Drawings.
      1. Install in full accordance with manufacturers instructions.

2.06 IN-LINE DOMESTIC HOT WATER RECIRCULATION PUMPS
   A. Provide in-line recirculation pumps where indicated and of capacities as scheduled.
   B. Type: Horizontal, oil-lubricated, designed for 125 psi working pressure, 225 degrees F continuous water temperature, and specifically designed for quiet operation.
   C. Body: Bronze
   D. Shaft: Steel, ground and polished, integral thrust collar with two horizontal sleeve bearings.
   E. Seal: Mechanical with carbon-seal faces rotating against ceramic seat.
   F. Coupling: Self-aligning, flexible coupling.
   G. Wire pumps to mechanical control circuits to shut down pump when A/C units are shut down.
   H. Manufacturers: Bell & Gossett ITT, PACO, TACO, or equal.

PART III - EXECUTION

3.01 INSTALLATION OF DOMESTIC HOT WATER HEATERS
   A. Install water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.
   B. Furnish wiring diagram to Electrical Installer. Refer to Division 16 for wiring of units, not work of this section.
   C. Connect hot and cold water piping to units with shutoff valves and unions with 6” brass nipples. Connect drain and relief piping as required.
   D. Start-up, test and adjust water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.
3.02 INSTALLATION OF PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Install base-mounted pumps on minimum of 4 inch high concrete pad, with anchor bolts poured in place. Set and level pump; grout under pump base with non-shrink grout. Provide drain line to nearest floor drain or floor sink.

D. Install in-line pumps with support from overhead structure on each side of pump, or as indicated on Drawings.

E. All booster pumps, return pumps, recirculating pumps shall have isolation valves upstream and downstream of pumps for repair or removal.

F. Piping shall be supported from the building structure so as to prevent any strain on the pump casings. A final check for perfect alignment of the piping connections shall be made after pump has been secured to its base. Provide valves, accessories, gauges, flexible connections, and supports as indicated.

G. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections. Do not proceed with equipment start-up until wiring installation is complete and correct.

H. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer. Align pump and motor with dial indicator gauges or laser alignment. Straight edge alignments will not be accepted.

I. Lubricate pumps before start-up. Start-up shall be in accordance with manufacturer's instructions.

J. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

3.03 TRAINING

A. Provide a minimum of 4 hours of training and orientation of University staff in proper care and operation of Water Heaters.

3.04 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.
3.05 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

END OF SECTION 15450
PART I - GENERAL

1.01 WORK INCLUDED

A. Types of hydronic specialties specified in this section include the following:

1. Vent Valves
2. Air Separators
3. Expansion Tanks
4. Chemical Feeders
5. Hydronic Piping
6. Water Relief Valves

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hydronic piping products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping."

2. CMC Compliance: Fabricate and install hydronic piping in accordance with IAPMO "Uniform Mechanical Code."

3. Welding materials and labor shall conform to ASME Code and applicable state labor regulations.

4. Welders shall be fully qualified and certified by a state approved welding bureau. Each welder shall identify his work with a marking stamped on each weld joint of pipe.

5. Copper brazing (including Medical Gas -Medical vacuum pipe and fittings):

   a. Certified yearly by P.I.P.E. or agency that meets AMS B2.2-85 brazing procedures, American Welding Society Standards.

   b. Show current brazing certificates upon request. Certification shall be copied and kept on file by Contractor for duration of the job and provided to University's Representative to be kept on file by University's Plant Operations and Maintenance Plumbing Supervisor.
1.03  SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of hydronic specialty.

B. Record Drawings: At project closeout, submit Record Drawings of installed hydronic piping and piping products in accordance with requirements of Division 1.

C. Maintenance Data: Submit maintenance data and parts lists for hydronic piping 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

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures or as specified. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems.

2.02 BASIC PIPES AND PIPE FITTINGS

A. Provide pipes and pipe fittings complying with Division 15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings," in accordance with the following listing:

1. Chilled Water Piping: 2" and smaller, Copper tube; Type L, hard-drawn temper: wrought-copper fittings. Solder joints 1 ¼” and smaller, brazed joints 1 ½ and larger. Connections to threaded equipment, valves, etc. shall be copper threaded or flanged fittings.

2. Chilled Water Piping over 2", ASTM A53 or ASTM A120 black steel, Schedule 40, with standard-weight, full-radius, butt-welding fittings and 150-lb, forged-steel, weld-neck type flanges. Connections to threaded equipment, valves, etc. shall be made with 150-lb, cast-iron, threaded fittings. Slip-on flanges will be permitted where space is limited with prior approval of the University's Representative. All slip-on flanges shall be back-welded. Piping over 2” can also be brazed copper, type L.

3. Heating Hot Water Piping: 2” and smaller, Copper tube Type L, hard-drawn temper: wrought copper fittings, brazed joints. Connections to threaded equipment, valves, etc. shall be copper threaded or flanged fittings. Connection to coils may be solder joints.

4. Heating Hot Water Piping: over 2", ASTM A53 or ASTM A120 black steel Schedule 40. On pipe sizes 2” and smaller, 150-lb, malleable threaded fittings. On pipe sizes 2-½” and larger, standard-weight, full-radius, butt-welding fittings and weld neck flanges, except slip-on flanges as specified for chilled water piping.
Connections to threaded equipment, valves, etc. shall be made with cast-iron, threaded fittings. Piping over 2" can also be brazed copper, type L.

5. Condenser Water Piping: ASTM A53 or ASTM A120 black steel, Schedule 40, with standard-weight, full-radius, butt-welding fittings and weld neck flanges.

6. Water and Drain Connections to Equipment or to Stubs by Plumbing Contractor: Schedule 40 steel pipe with 150-lb, malleable-iron fittings. Provide unions with 6" brass nipples if connections are to copper lines. Pipe and fittings shall be black or galvanized as required to match piping to which connected.

7. Air Vent Discharge Piping: Type-L, hard copper tubing with wrought copper solder joint fittings and 95% tin, 5% antimony solder.

8. Cooling Coil Condensate Drain Piping: ASTM A120 or ASTM A53 galvanized steel, Schedule 40 with 125-lb, galvanized, cast-iron fittings or 150-lb, galvanized, malleable-iron fittings. At Contractor's option, piping same as for air vent discharge piping may be used. Provide plugged tees or crosses at all changes in direction. Plugs shall utilize the same material as the primary piping or shall be equipped with unions with 6" brass nipples.

9. Relief Valve Discharge and Vapor Vent Piping: Same as specified for cooling coil condensate drain piping, except that plugged fittings will not be required.

2.03 AIR SEPARATORS

A. Provide air separators pressure rated for 125 psi. Select capacity based on total system gpm.

B. In-Line Air Separators: Provide in-line air separators as indicated. Construct sizes 1-½" and smaller of cast iron and sizes 2" and larger of steel complying with ASME Boiler and Pressure Vessel Code for 125 psig and stamped with "U" symbol.

C. Manufacturers: Amtrol, Inc., Armstrong Pumps, Inc., Bell and Gossett ITT; Fluid Handling Division, or equal.

2.04 EXPANSION TANKS

A. General: Provide expansion tanks of size and number as indicated. Construct of steel for 125 psi pressure rating complying with ASME Boiler and Pressure Vessel Code and stamped with "U" symbol. Furnish National Board Form U-1 denoting compliance. Provide tappings in bottom of tank for tank fitting; tappings in top and bottom of tank for gauge glass connections. Provide ¾", full-length gauge glass, with gauge cocks and cleanouts.

B. Tank Fittings: Provide tank fittings for expansion tanks as indicated, sized for tank diameter. Design tank fittings for 125 psi pressure rating and include manual vent to establish proper air volume in tank on initial fill.

C. Manufacturers: Amtrol, Inc., Wilkins, or equal.

2.05 DIAPHRAGM-TYPE EXPANSION TANKS

A. Provide diaphragm expansion tanks of size and number as indicated. Construct tank of welded steel, constructed, tested, and stamped in accordance with Section VIII of ASME Boiler and Pressure Vessel Code for working pressure of 125 psi. Furnish National Board
Form U-1 denoting compliance. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting and drain fitting.

B. Manufacturers: Amtrol, Inc., Wilkins, or equal.

2.06 CHILLED WATER AND HEATING WATER CHEMICAL FEEDERS

A. Provide chemical feeders of 5-gal. capacity or otherwise as indicated, constructed of cast iron or steel, for introducing chemicals in closed hydronic system. Provide funnel and valve on top for loading, drain valve in bottom, and recirculating valves on side. Construct for pressure rating of 125 psi.

B. Manufacturers:
   1. Dearborn
   2. Neptune Chemical Pump Company, Model DBF-5
   3. J.L. Wingert Company, Model 5HD
   4. Vulcan Laboratories, Subsidiary of Clow Corporation
   5. Or equal

2.07 COOLING TOWER SYSTEM CHEMICAL TREATMENT

A. Furnish and install an automatic feed and bleed system as diagramed on the Drawings. Equipment shall be as follows:

B. Electronic feed and bleed controller shall be UOP, or equal, equipped with power relay with a conductance range of 1,000 to 9,000 micro ohms.

C. Chemical pump shall be Precision Model 10611-321, or equal, with minimum capacity of 0.10 to 3.4 GPD at 75 psi. Provide with acrylic head and fittings and Hypalon diaphragm and valves.

D. The chemical tank shall be the chemical shipping container.

E. The solenoid valve shall be normally closed, slow opening and closing, Griswold Model 4160, or equal, with General Purpose (NEMA 1) enclosure.

2.08 BASIC VALVES

A. Provide valves complying with Division 15, Section 15050 – Basic Mechanical Materials and Methods, in accordance with the following listing.

B. Balance Valves:
   1. Shall be Armstrong, Tour Anderson, or equal in design. Valve 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 is balanced. Plug design valves are not acceptable. 90° turn adjustable valves are not acceptable.
C. Air Vent Valves:
   1. Manual air vents: At all high points, reheat coils, the air vent assemblies shall consist of a ½” IPS ball valve and ½” gooseneck pipe of same material as piping. Air vent valves shall be easily accessible within arms-reach at ceiling access.

D. Isolation Valves:
   1. Provide isolation valves on all Hydronic piping into and out of Mechanical Rooms.

2.09 WATER RELIEF VALVES

A. Provide water relief valves as indicated, of size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F and pressure relief at 125 psi.

C. Pressure Relief Valves: Watts Series 740, Hoffman, or equal, bronze body, test lever, ASME rated.

D. Manufacturers: Armtrol, Inc., Wilkins, or equal.

PART III - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which hydronic piping systems and specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF VALVES

A. Drain Valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere as indicated or required to completely drain hydronic piping system.
   
   1. Shall be ball valve with hose adapter and cap.

B. Check Valves: Install on discharge side of each pump and elsewhere as indicated.

3.03 EQUIPMENT CONNECTIONS

A. Connect hydronic piping system to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return; drain valve on drain connection.

   1. Shall be ball valve with hose adapter and cap.
3.04 INSTALLATION OF HYDRONIC SPECIALTIES

A. Vent Valves:
   1. Manual air vents: At all high points, reheat coils, the air vent assemblies shall consist of a ½” IPS ball valve and ½” gooseneck pipe of same material as piping. Air vent valves shall be easily accessible within arms-reach at ceiling access.
   2. Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain or as indicated.

B. In-Line Air Separators: Connect inlet and outlet piping.

C. Diaphragm-Type Expansion Tanks: Install diaphragm-type expansion tanks on floor as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system; charge tank with proper air charge as recommended by manufacturer.

D. Chemical Feeders: Install in upright position with top of funnel not more than 48” above floor. Install globe valve in pump discharge line between recirculating lines. Pipe drain to nearest plumbing drain or as indicated.

E. Water Relief Valves: Pipe discharge to floor drain or floor sink. Comply with ASME Boiler and Pressure Vessel Code.

3.05 INSTALLATION OF CHEMICAL TREATMENT SYSTEM

A. Comply with manufacturer's instructions for installation of chemical treatment system, except as otherwise indicated.

B. Piping shall be initially cleaned, before start-up of any equipment, with a suitable cleaning agent introduced into the piping system as recommended by the manufacturer. This treatment shall be circulated for not less than six hours, followed by flushing until neutral. Temporary circulating pumps shall be furnished by Contractor. Project pumps shall not be
used for this purpose. Condenser water shall not be circulated until chemicals are introduced into the piping system.

C. Provide test equipment to test conductivity by portable solids meter, range 9-2500 ppm; nitrite by drop test; pH in range of 5.5 to 8.5 by color comparator; alkalinity by titration.

D. Secure the services of a water treatment specialist who will perform the following work:

1. Supervise initial clean out of piping systems.
2. Supervise installation of chemical feed equipment to assure that all water treatment work is properly installed as specified.
3. Make water analysis and establish chemical and water balance to prevent corrosion and scale formation in the recirculating water.
4. Instruct the University's personnel in the use and control of the chemical treatments supplied.
5. After completion of work, submit recirculating water analysis and certification to University's Representative that all work has been performed in accordance with Drawings and specifications.
6. Provide a one-year's supply of the required chemicals to the University at the completion of the job.

3.06 FIELD QUALITY CONTROL

A. Test hydronic piping in accordance with testing requirements of Division 15, Section 15050 – Basic Mechanical Materials and Methods.

3.07 ADJUSTING AND CLEANING

A. Clean, flush, and inspect hydronic piping systems in accordance with requirements of Division 15, Section 15050 – Basic Mechanical Materials and Methods.

3.08 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.

B. After all equipment has been installed complete, the piping systems shall be cleaned as follows:

1. Add a solution of alkaline cleaner to the manufacturers recommended dosage. Circulate the system for 24 hours. Standby pumps should operate 50% of the circulation time, while all other pumps should operate 100% of the time. After 24-hour circulation time the system shall be drained, filled and operated repeatedly until clean and free of dirt and debris. Water quality should be that of incoming make-up water quality, and clarity should be clear. All strainers at pumps, control valves, and wherever else they are installed in the system shall have mesh elements removed, cleaned and/or replaced repeatedly until system can operate continuously without any dirt buildup on strainer elements. For closed loops add
a corrosion inhibitor per manufacturer’s recommendations and dosage to maintain a Nitrite level (NO2) of the following:

a. Chilled water loops: 200-400 ppm NO2
b. Heating hot water loops: 400-600 ppm NO2

3.09 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.10 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 15500
SECTION 15890
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.


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 30º for contracting tapers and 20º for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 15, Section 15910 – 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. **DIAMETER** | **MINIMUM GAUGE** | **METHOD OF MANUFACTURE**
--- | --- | ---
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. **DIAMETER** | **MINIMUM GAUGE**
--- | ---
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. **MAXIMUM WIDTH** | **MINIMUM GAUGE**
--- | ---
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. **MAXIMUM WIDTH** | **MINIMUM GAUGE**
--- | ---
Under 37" | 20
37" to 50" | 18
Over 50" | 16
G. Manufacturers:

1. MANUFACTURER      PRODUCT
   United Sheet Metal Div., United Magill Corp.  Uniseal
   Semco Manufacturing Incorporated
   Air Systems Incorporated - Las Vegas
   Or equal

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, 45º to 90º elbows for sizes up to 8”; five-piece, 90º 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 45º.

D. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 1-1/2” 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 ⅛” 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.


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 1-½”.

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 an 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 15890
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. Variable 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.


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 01330. 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 01780 and 15010 requirements.

PART II - PRODUCTS

2.01 TURNING VANES


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: Ventfabs, 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 ⅛ diameter ball bearings, ⅛ diameter steel axles spaced on 9" centers. Construct frame of 2" by ⅛" by ⅛" steel channel for face areas 25 sq. ft. and under; 4" by 1-⅛" 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.


F. Linkages: External only.


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 VARIABLE 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 15960, 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\frac{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 15910
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. Air handling units
3. Ductwork systems
4. Pumps
5. Coils and heat exchangers
6. Piping systems
7. Terminal units
8. 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:


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 Abode Acrobat complete with an interactive field linked Table of Contents (linked to the chapters and subsections within the report). Submit electronic copies on a CD (or CDs).

B. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

C. Provide submittal of completed balance report prior to request for final mechanical observation of the project.
1.04 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:


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. Pumps: Suction and discharge pressure.

4. Coils: Gallons per minute, fluid temperature, and air temperature at outlet and inlet.

5. Terminal Air Distribution Units: Cubic feet per minute and inlet static pressure.

6. Inlets, Outlets, and Main Branch Ducts: Air velocity and cubic feet per minute.
7. All Rooms: Air temperature during test.

8. 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.

I. Return Air Shaft Test: Upon completion of construction of shafts to be used for return air, and after all pipe and duct penetrations are sealed, independent test and balance agency shall test shaft for leakage. Submit to Contractor a complete test report, and if required by results of this report, Contractor shall make repairs to shaft for the purpose of making it airtight. Upon completion of these repairs provide a retest and submit final report of results to University's Representative. **Balance agency shall perform the following tests:**

J. Seal shaft at openings, including openings into duct runs.

K. Provide test orifice and check an allowable loss of 250 C.F.M. at test pressure of 1-inch static pressure at each shaft.

L. Test equipment shall be capable of delivering minimum of 1500 C.F.M. and develop twice static pressure required in shaft.

M. Determine measured leakage factor by use of hook gauge with connections across installed orifice plate. Submit leakage factor determined by these tests to Contractor for correction.

N. Submit test equipment used to University's Representative for review before beginning work.

END OF SECTION 15990
SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

PART I - GENERAL

1.01 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 16, 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 16180 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 15 including installation and connection of all relays, remote starters, etc. and the connection of all motors and controllers. Control wiring for Division 15 systems shall be provided by Division 15. Review Division 15 specifications and shop drawings for control systems to assure compatibility between equipment furnished under Division 16 and wiring furnished under Division 15. Motor controllers (starters) shall be furnished and installed under Division 16, 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 15.

1.02 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.

1.03 CODES AND STANDARDS

A. Applicable codes are those specified in Section 01410 – 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.

1.04 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.
1.05 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.

1.06 SUBMITTALS

A. Shop Drawings and Product Data:

   A. 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.

   B. Refer to the individual sections for identified equipment and materials for which submittals are required.

   C. Refer to Division 1 for required procedures.

B. Operation and Maintenance Data and Instruction:

   A. Refer to Division 1 for detail requirements.

   B. Printed Material: Provide required printed material for binding in operation and maintenance manuals.

   C. 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 II - PRODUCTS

2.01 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 01330. 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 an independent testing laboratory.

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 University; 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.

PART III - EXECUTION

3.01 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.

   A. 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, cable trays 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:

A. Install minimum 4" high concrete pads or as indicated. Other pad dimensions shall be as required to accommodate the equipment installed.

B. Use 3,000 PSI (14 Kg/s/mm) concrete.

C. Reinforce with 6" x 6" W2.9 x W2.9, 10GA (3.4mm) mesh, with short dowels into floor at 12" OC around perimeter.

D. Chamfer top edges ¾" (18mm).

E. Make all faces smooth.

F. Set anchor bolts for equipment. Consult with user.

G. Coordinate the size of all pads, the location of all anchor bolts, and the location of all vibration isolators.

3.02 QUALITY ASSURANCE AND PROJECT SAFETY

A. Provide quality assurance and project safety programs. Satisfy the minimum acceptable requirements provided in the specifications.
3.03 PREPARATION

A. Examine Drawings and Site; be familiar with types of construction where electrical installation is involved.

   A. 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:

   A. Refer to Division 1 for submittal requirements.

   B. Provide a schedule of values for the electrical work specified under Division 16. 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.).
3.04 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.

   A. 36" @ 250V and less.

   B. 42" @ 250V to 600V.

3.05 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.

D. During construction, all equipment and materials shall be maintained and protected at all times in the original condition received from the manufacturer and according to the manufacturer's requirements.

3.06 CARE AND CLEANING

A. Any equipment and/or panel interior cleaning or corrective measures required as a result of improper exposure to the construction environment shall be submitted to the University for review and approval before the work proceeds. Cleaning and/or corrective measures for equipment and panel interiors shall include manufacturer's requirements or recommendations.

B. Interior cleaning or corrective measures involving equipment and panels shall be completed by manufacturers or authorized representatives of manufacturers.
C. 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 exterior 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.

D. 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.

E. Clean light fixtures and lamps thoroughly, just prior to final inspection. Fixture enclosures, shielding, etc., shall be cleaned by an approved method.

F. 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.

G. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.

H. Where plywood backboards are used to mount equipment provided under Division 16, paint backboards with two coats of light gray semi-gloss fire retardant paint under Division 16. Labels shall be left exposed and shall not be painted.

I. All broken, contaminated, damaged or otherwise defective parts, equipment, and materials 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.

J. All surplus materials and debris resulting from this work shall be periodically cleaned out and removed from site; this includes surplus excavated material.

3.07 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.
3.08 CUTTING AND PATCHING

A. Provide necessary cutting and patching required to accomplish the work of Division 16.

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.

3.09 PROTECTION

A. In performance of work, protect work from damage. Protect electrical equipment, stored and installed, from dust, water or other damage.

3.10 EQUIPMENT IDENTIFICATION

A. Panelboards, remote control switches, terminal boxes, etc., shall be properly identified according to section 16195 of these specifications.

3.11 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.

3.12 ELECTRICAL SYSTEMS OPERATIONAL TESTS, MANUFACTURERS SYSTEMS CERTIFICATION AND DESIGN AUTHORITY ASSISTANCE

A. Testing:

A. 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.

B. Refer to the individual specification sections and Section 16960 of the specifications for test requirements.

C. 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.

D. All electrical systems shall be tested for compliance with the specifications.

B. Manufacturers Certifications:

A. 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.

B. 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

C. 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) Existing Fire Alarm System
2) Lighting Control System

3.13 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.

3.14 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.

3.15 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 16010
SECTION 16070
REMODELING ELECTRICAL INSTALLATIONS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. General requirements for remodeling and modifying existing electrical installations.
   2. Disposition of existing materials and equipment.

1.02 SUBMITTALS

A. Requests for service interruption to power, communications, telephone, etc.

1.03 UTILITY FEES

A. Include all SMUD charges for service location, connection charges, permits, or work performed by utility.

B. Utility: SMUD
   P.O. Box 15830
   Sacramento, CA 95852-1830
   916-732-5776

PART II - WORK REQUIREMENTS

2.01 GENERAL REQUIREMENTS

A. Obtain written approval from the University prior to interrupting services for power, communication, telephone, etc. All interruptions shall be planned shutdowns and must comply with the University's published standards.

B. The University will be occupying the existing building during construction. Provide any temporary connections necessary to maintain services to the existing electrical installation.

C. Work which involved a service outage to areas occupied by the University shall be performed on an overtime basis. Work shall continue until service is restored.

D. Coordinate all removal work to maintain services to all equipment and areas until such time as these items are removed or demolished.

2.02 ELECTRICAL INSTALLATION REMOVAL AND MODIFICATIONS

A. Abandoned Circuits and Equipment: Remove all wire back to its source wherever existing circuits are abandoned. Remove abandoned raceways and boxes unless concealed in concrete or masonry construction. Remove all abandoned electrical equipment.

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

C. Lighting Installations: Remove lighting fixtures located in areas where ceilings or walls are to be replaced and reinstall fixtures unless new fixtures are indicated. Where conduit and wiring serving these fixtures must be removed to permit demolition work, provide new conduit and wire to obtain the same circuit arrangement as originally existed.

D. Equipment Reuse:

1. Assume that all existing equipment and fixtures indicated to be reused are in good working condition and can be installed without repairs. Items found to be in need of repair or in unusable condition, shall require notification of the University’s Representative for direction or decision. Any damage to equipment caused in removal or handling shall be corrected under this contract.

2. Fixtures and other equipment removed and to be re-used shall be cleaned before reinstallation. Provide new lamps for reused light fixtures.

E. Added Circuits: All loads and circuits to existing panelboards shall be balanced between phases. On existing panelboards where circuits are changed, revise panel directories with new typed directories.

PART III - EXECUTION

3.01 DISPOSITION OF EXISTING MATERIAL AND EQUIPMENT

A. All material and equipment which is noted or required by the University to be salvaged and which is not scheduled to be reused or relocated shall be carefully removed and shall be delivered to the University and stored where directed on the site.

B. Carefully remove and store on the site all material and equipment noted or specified to be reused or relocated. Thoroughly clean this equipment prior to installation.

C. Remove all other materials or debris resulting from demolition operations from the site.

3.02 DISPOSITION OF EXISTING FLUORESCENT TUBS AND BALLASTS CONTAINING (PCBs)

A. Environmental Protection Agency (EPA) Regulations required controlled disposal of fluorescent light ballasts containing polychlorinated biphenyls (PCB’s) when removed from service. The ballasts involved were generally manufactured between 1950 and 1979.

B. Provide suitable fluorescent tube collection containers and ballast collection containers at the project site. Check the ballasts in all fluorescent fixtures removed from service under this contract. Some ballasts may be labeled to indicate whether they do or do not contain PCBs. Remove from the fixtures all ballasts known or assumed to contain PCBs and place them in the designated ballast collection container and arrange for the disposal of the ballasts off the site in manner approved by the EPA. Fluorescent lamps shall be recycled at an authorized facility.

END OF SECTION 16070
PROJECT NO. 9559620
MEDICAL RECORDS BUILDING REFURBISHMENT

SECTION 16110
RACEWAYS

PART 1 - 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

   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 2 - 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, 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 "concrete tight" 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. Set screw 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 degree 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 ½" 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.
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.

All flexible conduit shall be classified as suitable for system grounding.

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.

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.

No aluminum flexible conduit shall be used.

Vinyl all weather electrical tape for corrosion protection shall be Scotch #88, Tomic #85, Permacel #295 or equal.

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 degree angular deflections. Couplings shall contain an internal flexible metal braid to maintain raceway system ground continuity.

Fire and smoke stop materials shall be UL rated to maintain the fire floor or fire wall partition rating.

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.

Exposed conduit below 8'-0" shall be rigid type.

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.

Support conduits per seismic guidelines outlined in section 16012.

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 feet or where conduits pass building expansion joints.

19. Telephone, 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, 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 feet 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. In suspended or accessible ceilings above 8 feet.

d. Exposed in dry locations above 8 feet where not subjected to mechanical damage.

e. In furred ceiling spaces.

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, 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 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 conduit.

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 6" 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 ¼" 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 a 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 1".

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 ft. and within three feet 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 ft. with conduit beam clamps, 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 fire walls or fire floors to maintain fire rating of wall or floor.

9. Conduits rigidly secured to building construction on opposite sides of a building expansion joint shall be provided with an expansion and deflection coupling. In lieu of an expansion coupling, conduits 2–½" and smaller may be provided with junction boxes on both sides of the expansion joint connected by 15" of slack flexible conduit with bonding jumper.
3.02 ADJUSTMENT, CLEANING AND PROTECTION

A. Clean: Upon completion, clean all installed materials of paint, dirt, and construction debris. All conduit systems shall be cleaned of water and debris prior to the installation of any conductors.

END OF SECTION 16110
PART 1 - GENERAL

1.01 SUMMARY
A. Section includes:
   1. Surface metal raceways.
   2. Multi-outlet assemblies.
   3. Fittings, devices and plates.
   4. Mounting supports

1.02 SUBMITTALS
A. Product Data: Submit in accordance with Division 1.

1.03 REFERENCE STANDARDS
A. UL
B. NEMA
C. ANSI

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Wiremold, or equal.
B. Wiremold numbers are used to identify sizes and types.

2.02 SURFACE RACEWAY TYPES
A. The surface raceway types listed in this article refer to Wiremold nomenclature and shall be assembled with receptacles to be multi-outlet assemblies.
   1. Finish: ANSI #61 Gray.
B. Type 2100: \(\frac{7}{8}\)"b x 1–\(\frac{1}{4}\)"w base and cover constructed of .040" thick steel.
   1. Receptacles: 20 ampere 125 volt 3 wire grounded single receptacle.
   2. Spacing: 18" o.c. single circuit.
C. Type 2200: \(\frac{3}{4}\)"b x 2–\(\frac{1}{4}\)"w base and cover constructed of .040" thick steel. Provide divider when used for communications and power.
1. Receptacles: 20 ampere, 125 volt, 3 wire grounded duplex receptacle.

2. Spacing: 24" o.c., 2 circuit alternately wired.

D. Type G-3000: 1-17/32"b x 2-3/4"w base and cover constructed of .040" thick steel. Provide divider when used for communications and power

1. Receptacles: 20 ampere, 125 volt grounded duplex specified in Section 16140 - Devices or special receptacles as indicated on the drawings.

2. Spacing: 24" o.c. or as indicated. Circuit as indicated on the drawings.

E. Type G-4000: 1-3/4"b x 4-3/4"w base constructed of .050" thick steel for base and cover .040" thick steel. Provide divider when used for communications and power.

1. Receptacles: 20 ampere, 125 volt grounded duplex as specified in Section 16140 Devices or special receptacles as indicated on the drawings.

2. Spacing: 24" o.c. or as indicated. Circuit as indicated on the drawings.

F. Type G-6000: 3-9/16"b x 4-3/4"w base constructed of .060" thick steel and cover of .040" thick steel. Provide divider when used for communications and power.

1. Receptacles: 20 ampere, 125 volt grounded duplex specified in Section 16140 - Devices or special receptacles as indicated on the drawings.

2. Spacing: 24" o.c. or as indicated. Circuit as indicated on the drawings.

2.03 FITTINGS AND ACCESSORIES

A. Fittings:

1. Raceway system with factory couplings, elbows, tees, corners, end fittings, panel connectors, conduit connectors, and device brackets.

B. Devices:

1. Devices shall be standard as specified in Section 16140 - Devices. Mount at locations and spacings as specified or shown on the drawings.

C. Plates:

1. Plates shall be stainless steel for raceways 2-3/4" wide or larger as specified in Section 16140 - Devices. Install plates at all device locations.

D. Mountings and Supports:

1. All mounting clips, C-hangers, T-bar clips, and mounting supports shall be by the same manufacturer and shall be furnished where required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install surface raceway at locations shown on the drawings.
B. Field cut raceway and cover to lengths required for finished installation.

C. Secure raceway through the back with metal or wood screws, as the supporting structure dictates.

D. Provide surface raceways with a green color insulated copper ground conductor. This conductor shall be connected to the supply panelboard ground bus and to each ground screw on each receptacle.

E. Branch circuit feed to surface raceway shall be concealed behind raceway by direct conduit connection to base channel or outlet box where base channel will cover the entire box.

F. Wiring devices, raceway, boxes, covers, and conductors shall be labeled with information descriptive of the installed system(s). Label materials, lettering, and attachment shall be provided according to section 16195.

END OF SECTION 16112
PART I - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cable Tray
   2. Attachment and Accessories
   3. Supports

B. Cable trays in equipment rooms.

1.02 REFERENCE STANDARDS

A. UL
B. NEMA
C. ASTM

1.03 SUBMITTALS

A. Shop Drawings:
   1. Submit in accordance with Division 1.
   2. Provide layout plans, product information describing all parts and accessories. Provide loading and deflection tables. Show structure, ductwork, and piping on shop drawings to confirm field installation coordination.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. B-Line
B. Cablofil
C. Cope
D. Husky
E. or equal

2.02 CABLE TRAY

A. Provide a complete cable tray system including all necessary hardware, horizontal bend fittings, vertical inside and outside bend fittings, tees, crosses, offsets, splice plates, blind end plates, hanger rods and clamps and support hanger brackets as required, and as
shown on plans. Vertical and horizontal offsets shall be provided as necessary to coordinate with the mechanical and structural installation.

B. Systems shall meet NEMA 12A and have a loading depth of 4". All tray will support without collapse 200 lbs. over and above allowable load. Tray and fittings shall be manufactured of pregalvanized steel. Transverse members shall be welded to the side rail. No part of the cable tray shall protrude below the bottom of the side rail.

C. Trays shall be 6", 9", 12", 18" or 24" wide as to not exceed 50% fill or as indicated on plans. Tray shall be furnished in standard 12' lengths.

D. The cable trays shall be filled to no more than that permitted by CEC 318-9.B

2.03 CABLE TRAY SUPPORTS

A. Provide two support rods every 8' or wall bracket support where applicable. Rod support shall be ½" minimum threaded steel rod firmly attached to structure by beam clamps, swivel joints, concrete anchors, or concrete inserts. Installation shall comply with all applicable seismic requirements.

2.04 CABLE TRAY ATTACHMENTS AND ACCESSORIES

A. Provide all cable tray accessories required for a complete installation. Accessories shall include, bonding jumpers at joints, dropout cable exits and conduit clamps where conduit terminates at the cable tray.

2.05 FIRE BARRIERS

A. Provide cable tray fire barriers at all points where the cable tray penetrates a fire barrier wall or floor as specified in Division 7 Firestopping. The F rating shall apply to all through penetrations and shall not be less than the required fire-resistance rating of the assembly penetrated. The T rating shall apply to all walls requiring protected openings as defined by Title 24, CBC 4304 and 4308.

PART III - EXECUTION

3.01 INSTALLATION

A. Assemble and install all cable tray components to form a complete system. All components shall be by the same manufacturer. Field modify cable tray to accommodate any structure or mechanical conflicts. Modifications shall be made with cable tray Manufacturer's UL listed components only.

B. Install all joints and connections using bolted plates. Install a bonding wire at all connections to assure electrical continuity. The cable tray system shall be bonded at all service points.

C. Secure cables installed in cable tray to the tray with plenum rated tie wrap every 2'.

D. Bracket all branch conduits to the cable tray system using conduit clamps and brackets. Ensure continuous grounding systems per CEC requirements.

E. Install expansion joints in the cable tray system at all building expansion joints.
F. Cable tray drop out plates at all points where cable drops out of the bottom of the cable tray.

G. All applicable seismic requirements shall be met. Refer Section 16012 of these specifications.

H. Field modify cable tray to avoid conflicts with mechanical ductwork, piping or structural elements.

I. The wire basket shall be installed in such a manner that a minimum of 12” of clearance on one side of the tray to permit access for installing and maintaining cables.

J. Modifications shall be made with cable tray Manufacturer’s UL listed components only.

K. Install cable tray at 90” AFF in equipment rooms.

L. All cables installed within the cable tray system shall be (power-limited tray rated cable).

M. No conduit shall be installed on or be run attached to cable tray.

END OF SECTION 16113
PART 1 - GENERAL

1.01 GENERAL INFORMATION

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire basket support systems as shown on the drawings.

B. Wire basket support system is defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, grounding components and accessories.

C. Unless otherwise noted the wire basket tray shall be the main support system as shown on drawings and shall contain only communication and low-voltage cable systems (no cables supporting Class 1 circuits shall be installed in this tray). It may be supplemented with a non-continuous cable support system.

D. Wire basket cable tray shall be used only outside of equipment rooms.

1.02 RELATED WORK

A. Division 16, Section 16012 – SEISMIC CONTROL – OSHPD

B. Division 16, Section 16110 – RACEWAYS

C. Division 16, Section 16113 – CABLE TRAY

D. Division 16, Section 16131 – PULL, SPLICE, AND JUNCTION BOXES

1.03 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code

B. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

C. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

D. ASTM A123 – Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

E. ASTM A510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

F. NEMA VE 2-2000 – Cable Tray Installation Guidelines


Requirements for Telecommunications


1.04 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general routing of the wire basket tray system. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys or coordinate with other trades as to the final location prior to submitting system layout drawings.

1.05 SUBMITTALS

A. Submittal Drawings: Submit drawings of wire basket and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps, support/bracing system and hold down plates showing accurately scaled components. Contractor shall provide field investigation to coordinate with existing conditions and other trades prior to submitting shop drawings.

1. The drawings are to show the various methods that will be used to support the wire basket tray with pertinent seismic information so a reviewer can determine if the proposed support design will meet seismic requirements.

B. Product Data: Submit manufacturer’s data on wire basket support system including, but not limited to, types, materials, finishes and inside depths.

1. The Information in the Submittal document shall be in the same sequence as the specification. Failure to organize the submittal package as requested may be grounds for outright rejection of the submittal.

1.06 QUALITY ASSURANCE

A. Cable tray shall be listed and labeled by Underwriters Laboratories (UL) as required

B. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

C. NFPA Compliance: Comply with NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to installation of cable tray systems.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver wire basket support systems and components carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.
B. Store wire basket and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, wire basket support systems to be installed shall be as manufactured by Cooper B-Line, Inc., GS Metals or equal.

2.02 WIRE BASKET SECTIONS AND COMPONENTS

A. General: Provide wire basket of type indicated; sized to not exceed 50% fill capacity; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Materials and Finishes: Material and finish specifications for each wire basket type are as follows:

1. Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.

C. All straight section longitudinal wires shall be straight (with no bends).

D. Wire basket shall be made of high strength steel wires and formed into a standard 2" x 4" wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

E. Wire basket sizes shall conform to the following nominal criteria:

1. Straight sections shall be furnished in standard 118" lengths.

2. Wire basket shall have a 6" usable loading depth by 18" wide UON on drawings.

F. All fittings shall be field formed as needed.

G. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.

H. Special accessories shall be furnished as required to protect, support and install a wire basket support system. This shall include but not limited to threaded rod protectors, grounding clamps, and marking plates.

I. Provide Radius Shields at all bends, tees and crosses.

J. Provide grounding clamps and #6 AWG ground wire

2.03 TYPE OF WIRE BASKET SUPPORT SYSTEM

A. Wire basket supports shall be a seismically braced trapeze hangers system or wall brackets
as manufactured by same manufacture as the basket tray.

B. Trapeze hangers shall be supported by ¼" or ⅜" diameter rods.

2.04 FIRE BARRIERS

A. If the wire basket tray needs to penetrate through a firewall provide Specified Technologies assembly WL-4043 WJ 4043 or equal (no known equal).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wire basket as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA’s “Standards of Installation” pertaining to general electrical installation practices.

B. Coordinate wire basket with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. The wire basket shall be installed in such a manner that a minimum of 12” of clearance above wire basket tray to permit access for installing and maintaining cables.

D. The wire basket shall be installed in such a manner that a minimum of 12” of clearance on one side of the tray to permit access for installing and maintaining cables.

E. The cable tray support system shall meet current Title 24 requirements.

1. The support design shall be approved by a Structural Engineer licensed in the State of California.

2. Support design and calculations shall be part of the shop drawing submittal package

F. Cable tray shall be supported from structural ceiling at a maximum of 6’ on center and at each bend, cable drop out elbow, tee, and reduces with trapeze-style hanger.

G. Abrasive supports (e.g. threaded rod) shall be protected with a smooth, non-scratching covering so that cables can be pulled by the support without physical damage.

3.02 FIRE-RATED BARRIERS

A. If the wire basket tray penetrates through a firewall install all components of the fire-rated assembly even if there are no cables present.

3.03 SEISMIC JOINTS

A. If a seismic joint is encountered in the wire basket tray run provide for a gap of 12” at the seismic joint. The tray shall be braced on each side of the gap. The draft is still the latest and greatest. Since we have not had a review with the owner and received comments it is still best to call this a draft. Based upon the meeting and comments the document will be revised to final.
3.04 TESTING

A. Test wire basket support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the “worst case” loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1.

3.05 CABLE TRAY ATTACHMENTS AND ACCESSORIES

A. Provide all cable tray accessories required for complete installation. Accessories shall include but not limited to, bonding jumpers at joints, dropout cable exits and conduit clamps where conduit terminates at the cable tray.

3.06 PROJECT DOCUMENTATION

A. Submit the following record drawings and documentation following completion and testing (and rectification, as necessary). In addition, provide a copy of all documentation in electronic format (AutoCAD, MS Office Excel 2003 version, etc).

1. Reproducible as-built drawings (one vellum electronic files of record drawing in AutoCAD, version 12 or higher) showing locations of all basket tray installed, with notation as to vertical clearances and elevation changes.

END OF SECTION 16114
PART 1 - GENERAL

1.01 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.

1.02 RELATED WORK

A. Section 16111 – Conduit

1.03 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 manufacturer's 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
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.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with the Conditions of the Contract and Division One Specifications Sections for the conductors, terminations, connectors, insulating tape, and insulating kits.

B. Submit field test reports indicating and interpreting test results required by the "Electrical Equipment Acceptance Testing" section of these specifications.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS REQUIREMENTS

A. Provide all materials under this section of the specifications.

B. All wire and cable shall be UL listed and shall bear a UL label along the conductor length at intervals not exceeding 24 inches.

C. All conductors shall have size, grade of insulation, voltage and manufacturer's name permanently marked on the outer cover at intervals not exceeding 24 inches.

D. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall not be less than indicated on the drawings. The minimum size of emergency systems conductors shall be No. 10 AWG.

E. Insulation voltage level rating shall be 600 volts.

F. All conduit and conductor sizes indicated on the drawings are based upon copper conductors. 60C ampacities shall be used for sizing of all wire and cable for branch circuits and feeders rated below 125 amps. 75C ampacities shall be used for sizing of all wire and cables for feeders rated 125 amps and above.

G. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.

2.02 PRODUCT/MATERIALS DESCRIPTION – CONDUCTORS

A. Conductors shall be stranded copper, 90oC, 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 (150oC), or No. 16 AWG thermoplastic, nylon jacketed stranded fixture wire, type TFFN (90oC). 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 vapor tight fixtures shall be type AF.
C. Control conductors for use on 120 volt control wiring systems shall be No. 12 AWG stranded type THHN/THWN, where properly protected, unless indicated otherwise on the drawings. Switch legs are not considered control wiring.

D. Portable power cables and outlets shall be provided where indicated on the drawings. Cables shall be sized as indicated on the drawings with equal size green equipment ground. Cables shall be jacketed 600 volt SO type. Cable connectors shall be steel case liquid tight sized for cable diameter and shall use strain relief gland fitting to prevent tension on conductor terminals. Where cable drops are indicated on the drawings, use wire mesh strain relief cable grips at both ends of cable. Use cast type outlet device box for device cable drops.

E. Wire shall be 1991 Code type copper wire of not less than 98% conductivity. All wires shall be stranded. Wires shall bear the Underwriters' label, be color coded and be marked with gauge, type and manufacturer's name on 24" centers.

2.03 SPLICES, TAPS, AND CONNECTORS

A. Splices, taps and connectors (No. 10 AWG and smaller) - Splices and joints shall be twisted together electrically and mechanically strong and insulated with approved type insulated electrical spring connectors.

B. Splices, taps and connectors (No. 8 and larger) - Joints and connections shall be made with Burndy, T & B, or equal, solderless tool applied pressure lugs and connectors. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire and with all irregular surfaces properly padded with "Scotchfil", 2nd product or equal putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1, or equal. Feeder splicing, where permitted, shall be made with high compression sleeve type connector followed by manufactured splicing kit utilizing as insulators, resins poured into a ready-to-use plastic mold to provide a uniform, moisture-proof tough, impact-resistant insulation. Hydraulically applied crimping sleeve or tap connector sized for the conductor. Insulate the hydraulically applied connector with 90°C, 600 volt insulating cover provided by the connector manufacturer. Insulator materials and installation shall be approved for the specific application, location, voltage and temperature and shall not have an insulation value less than the conductor being joined.

C. Electrical insulating tape shall be 600 volt, flame retardant, cold and weather resistant, minimally .85 mil thick plastic vinyl material; Scotch No. 88, Tomic No. 85, Permacel No. 295, or equal.

PART 3 - EXECUTION

3.01 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 torqueing 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. Make connections between fixture junction box and fixture with fixture wire.

K. Control, communications or signal conductors shall be installed in separate raceway systems from branch circuit or feeder raceway, unless indicated otherwise on the drawings.

L. Conductor lengths for parallel circuits shall be equal. Do not configure isolated phasing in separate conduits for parallel conductors.

M. Install a minimum of twelve inches (300 mm) of slack conductor at each outlet.

N. Thoroughly clean conductors prior to installing lugs and connectors.

O. 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.
P. Conductors removed from conduit for any reason after installation shall be replaced with new and shall not be re-installed.

3.02 IDENTIFICATION

A. Color Code Conductors:

1. Color code all secondary service, feeder and branch circuit conductors. Control and signal system conductors need not be color coded.

2. Coding shall be as follows:

   a. 208Y/120 volt three phase four wire wye system - Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White, Travellers: Orange.

   b. 480Y/277 volt three phase four wire system - Phase A: Brown, Phase B: Violet, Phase C: Yellow, Neutral: Gray, Travellers: Pink.

   c. Grounding conductors shall be green. Grounding conductors for isolated ground circuits shall be green with a yellow trace.

3. Phase conductors No. 10 and smaller shall have solid color compound insulation or color coating. Phase conductors No. 8 and larger shall have solid color compound, color coating or colored phase tape. Colored tape shall be installed on conductors in every box, at each terminal point, cabinet, through manhole or other enclosure.

B. Conductors within pull boxes shall be grouped and identified with nylon tie straps with circuit identification tag.

C. Identify each control conductor at its terminal points with wrap around tape wire markers. I.D. to indicate terminal block and point designation, or other appropriate identifying indication.

D. Refer to ELECTRICAL IDENTIFICATION section of these specifications for additional identification requirements.

3.03 TESTING

A. Refer to Electrical Equipment Acceptance Testing section of this specification for testing requirements.

END OF SECTION 16120
SECTION 16131
PULL, SPLICE, AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior Boxes
   2. Exterior Boxes

B. Excludes
   1. Floor Boxes
   2. Device and Outlet Boxes

1.02 SUBMITTALS

A. Required for boxes larger than 5-inches square.

1.03 REFERENCES

A. Underwriters Laboratories (UL)

B. National Electrical Manufacturers Association (NEMA) #250 - Enclosures for Electrical Equipment (1000 volts maximum).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hoffman; Jensen

B. O.Z. Gedney; General Signal

C. Emcor; Crenlo, Inc.

D. Or equal

2.02 PULL, SPLICE, AND JUNCTION BOXES

A. Indoor general-purpose boxes shall be a NEMA 1 enclosure, constructed of code gauge galvanized steel. The boxes shall be constructed from a single piece of steel with folded and welded corners. Boxes shall have hinged covers or flat removable, galvanized sheet metal covers held in place with binder head sheet metal screws.

B. Outdoor boxes surface mounted above ground in wet locations shall be cast iron with a plain cast iron cover. Covers shall be neoprene gasketed and shall be NEMA 4 watertight construction. The cover shall be held in place by stainless steel screws.
C. Size boxes based on code and working space requirements related to the number and size of conduits and wire entering the box.

D. Underground boxes - Underground boxes over 24-inches square shall be sized to provide floor space for workers to stand in the box without the need to stand on conductors in the box.

E. For recessed boxes, use an outside flanged recessed cover. For outdoor boxes mounted on exterior surfaces, use an unflanged box with weather seals.

F. Conduit openings shall be bossed, drilled and tapped in outdoor boxes.

G. Standard size metal boxes stamped from galvanized steel shall be used for indoor above ground general purpose where size and capacity are acceptable by code.

H. Boxes shall be of the depth required for wiring capacity.

I. Above ground outdoor boxes shall be cast iron with threaded hubs for vapor tight and wet locations where indicated.

J. Boxes for hazardous (classified) locations shall be approved for the classification and use.

K. Provide boxes with a blank cover.

L. Underground boxes 24-inches square or larger shall be high density reinforced concrete with end and side knock-outs. All such boxes shall be back filled around the outside with concrete. Each shall be equipped with the following reinforced concrete accessories:
   1. Extensions as required
   2. Box floor
   3. Lid with hold down bolts and labeled with usage. (Steel checker plate with hold down bolts in traffic areas.)

PART 3 - EXECUTION

3.01 INSTALLATION

A. All pull, splice, and junction boxes required are not shown on the plans; however, they shall be provided to meet Code requirements and as necessary to improve ease of wire pulling. Provide pull boxes or junction boxes in conduit runs over 90’ long or when more than 4 quarter bends occur in a conduit run.
   1. Pull boxes for communication or security cable shall be provided for runs over 90’ or when the run contains the equivalent of more than two 90° turns in any dimensional plane. See details for proper orientation and sizing of the pullbox.

B. Mount all above ground boxes securely to the building or structure. Boxes shall not depend on conduit for support.

C. Install all boxes such that covers are accessible.

D. Cut or sheared edges shall be filed or honed, eliminating all sharp edges.
E. Boxes shall be installed with unused or open knockouts plugged.

F. Install boxes direct buried in earth or concrete flush with surface, square with surrounding structures.

G. All above ground boxes shall be labeled on the cover indicating circuit number and panel number.

H. Splices shall occur in boxes sized for splicing, not in pull boxes or junction boxes.

I. Spare conduits - Spare conduits provided in boxes shall be located closest to box covers. Conductors shall not be installed above spare conduits.

J. Conduit turns – Turns or changes in direction in conduit runs shall occur outside of the box for conduit sizes larger than 2-inches.

K. Conductor and accessories – Conductors and accessories shall be installed to maximize working space inside boxes.

END OF SECTION 16131
SECTION 16132
FLOOR BOXES

PART I - GENERAL

1.01 SUMMARY

A. Scope: This section provides complete UL listed floor outlet assemblies for electrical power only. Floor boxes for Telecommunications, AV, or a combination of such services with electrical power are provided by those sections of the specifications.

B. Section Includes:

1. Pressed Steel Floor Boxes
2. Cast-iron Floor Boxes
3. Service Fittings and Accessories
4. Wiring Devices (According to Section 16140)
5. Data Jacks / Accessories (According to Section 16790)

1.02 SUBMITTALS

A. Product Data: Submit in accordance with Division 1. Describe each type of floor outlet and all accessory fittings.

1.03 REFERENCE STANDARDS

A. Underwriters Laboratories (UL)

B. National Electrical Manufacturers Association (NEMA) #250 - and OSI

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Floor Box Outlets and Accessories:

1. Walker.
2. Thomas and Betts.
3. Or equal.

B. Surface fitting poke-thru floor outlets:

1. Walker Legrand Evolution Series.
2. Hubbell.
3. Or equal.
C. Flush fitting poke-thru floor outlets.
   1. Walker Legrand Evolution Series.
   2. Raceway Components.
   3. Or equal.

D. Surface Mounted Box Systems
   1. Extron AVTrac 484 System
   2. Or equal

2.02 FLOOR BOX OUTLETS

A. Concrete tight: Formed Steel, fully adjustable, installed at above grade floor levels.

B. Watertight: Cast iron, fully adjustable, installed at grade level and below.

C. Box Depth: Provide maximum depth box acceptable for floor construction. Provide shallow box only where approved by the University's Representative.

D. Capacity: Provide multi-gang boxes where required for the services indicated on the drawings. Box sizes are not indicated on the drawings.

E. Accessories: Provide all necessary accessories for a finished installation including gaskets, floor plates, covers with removable plate, device mounting plates, carpet flanges, services fittings and outlet devices.

F. Finish: Finish of exposed accessories shall match the finish specified for service fitting.

G. Wiring Devices: Provide as indicated on the plans and as specified in Section 16140 and the Sections which specify the system outlet indicated.

2.03 FLOOR OUTLET SERVICE FITTINGS

A. Flush Floor Service Fittings: Provide flush service fittings unless otherwise indicated.
   2. Duplex Receptacle - Power: Duplex flush flip lid cover plate.
   3. Finish: Coverplates, trim rings and carpet flanges shall be finished as follows:
      a. Brass

B. Above Floor Service Fittings: Provide above floor service fitting only where indicated by notes on the drawings or where approved by the University's Representative.
   1. Single or Duplex Receptacle: Die cast aluminum construction housing with front and back removable plates for the devices indicated. Provide locking baseplate to secure housing.
   2. Finish: Housing and faceplates shall be finished satin aluminum.
2.04 SURFACE MOUNTED BOX SYSTEMS

A. Shall consist of the Extron AVTrac 484 system and accessories, or equal, for power only under this specifications section. See the Telecommunications and Audio-Visual specifications sections for requirements where this product is used in those systems.

B. Hospital grade duplex receptacles shall be provided where indicated.

PART III - EXECUTION

3.01 INSTALLATION - FLOOR OUTLETS

A. Install floor outlets securely anchored into the building construction and level.

B. Protect outlets during construction preventing entrance of foreign materials.

C. Install and assemble outlets according to manufacturer's instructions.

D. Install cast iron floor outlet boxes in all floors at and below grade, in damp or wet locations, or as indicated. In all other locations install pressed steel floor outlet boxes.

E. Orient above-floor service fittings to face as indicated on the plans or as directed by the University. Install wiring devices complying with Section 16140 – Devices and as shown on the plans.

3.02 INSTALLATION - POKE-THRU OUTLET

A. Core drill holes for poke-thru assemblies, install according to manufacturer's instructions, and maintain UL fire rating of floor-ceiling assembly.

B. Verify location of and avoid core drilling holes at reinforcing bars or through joists of pan-joist type floor construction. Bore holes evenly through the floor, do not break the bottom of the hole damaging the seal between the assembly and the concrete.

C. Verify final locations of outlets with University's Representative from final furniture plans before core drilling holes.

D. Core-drilled holes shall be spaced a minimum of two feet on center and not more than one hole per each 65 square feet of floor area in each building span. All slab penetrations shall be pre-approved by the structural engineer.

3.03 INSTALLATION - SURFACE FLOOR BOX SYSTEMS

A. The Extron AVTrac 484 system and accessories, or approved equal, shall be installed according to the manufactures instructions and contract requirements.

B. Floor, wall, and ceiling penetrations and attachments to structure necessary for installation shall be provided by qualified construction personnel as defined in the contract documents.

C. Submittals shall be provided for review and approval of the products and verification of installer qualifications before proceeding with installations.

END OF SECTION 16132
SECTION 16135
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 ⅜" 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 and conduit systems to the structure. 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 ¾” 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 1/16", or are recessed no more than 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 1-1/2" 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 2-1/8" 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 16135
SECTION 16140  
WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Wall Switches
   2. Receptacles
   3. Device Plates
   4. GFI Receptacles
   5. Occupancy Sensors
   6. Photocells

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 2 - 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:

<table>
<thead>
<tr>
<th>Poles</th>
<th>Amps</th>
<th>Volts</th>
<th>Cat. No.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>20</td>
<td>277 - AC</td>
<td>1221-2</td>
<td>Toggle-Quiet</td>
</tr>
<tr>
<td>Double</td>
<td>20</td>
<td>277 - AC</td>
<td>1222-2</td>
<td>Toggle-Quiet</td>
</tr>
<tr>
<td>Three Way</td>
<td>20</td>
<td>277 - AC</td>
<td>1223-2</td>
<td>Toggle-Quiet</td>
</tr>
<tr>
<td>Four Way</td>
<td>20</td>
<td>277 - AC</td>
<td>1224-2</td>
<td>Toggle-Quiet</td>
</tr>
<tr>
<td>SPDT</td>
<td>20</td>
<td>277 - AC</td>
<td>1257</td>
<td>Momentary Contact</td>
</tr>
<tr>
<td>Single</td>
<td>20</td>
<td>120/277 - AC</td>
<td>1221LH/7L Lighted Handle</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>20</td>
<td>120/277 - AC</td>
<td>1221PL/7P Pilot</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>20</td>
<td>277 - AC</td>
<td>1221-2L</td>
<td>Locking Type</td>
</tr>
<tr>
<td>Single</td>
<td>20</td>
<td>277 - AC</td>
<td>1221 w/cover</td>
<td>Weather Proof</td>
</tr>
</tbody>
</table>

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 wherever receptacles are indicated. 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:

<table>
<thead>
<tr>
<th>Poles/</th>
<th>Wires</th>
<th>Volts</th>
<th>Amps</th>
<th>Configuration</th>
<th>Cat. No.</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2P-3W</td>
<td>125</td>
<td>20</td>
<td>5-20R</td>
<td>8300</td>
<td>General Duplex</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>125</td>
<td>20</td>
<td>5-20R</td>
<td>8898-HG</td>
<td>General GFI Duplex</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>125</td>
<td>30</td>
<td>5-30R</td>
<td>5371</td>
<td>Equipment Single</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>250</td>
<td>20</td>
<td>6-20R</td>
<td>5461</td>
<td>Equipment Single</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>250</td>
<td>30</td>
<td>6-30R</td>
<td>5372</td>
<td>Equipment Single</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>125</td>
<td>20</td>
<td>5-20R</td>
<td>TR62-H</td>
<td>P&amp; S. Tamper Resistant</td>
<td></td>
</tr>
<tr>
<td>2P-3W</td>
<td>125</td>
<td>20</td>
<td>5-20R</td>
<td>8300-IG</td>
<td>Isolated Ground</td>
<td></td>
</tr>
</tbody>
</table>

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 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. Sierra #S3733-SS, or equal.

D. Engraving:

1. All device plates shall be engraved on the face with ¼" 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 OCCUPANCY SENSORS

A. Provide occupancy sensors in the locations indicated on the documents for control of the rooms indicated. Occupancy sensors shall be Watt Stopper or equal. Provide power supplies as indicated by manufacturer to allow a fully functioning system.

B. Devices indicated on the plans shall include:

1. Passive Infrared Occupancy Sensor
2. Ultrasonic Occupancy Sensor
3. Combination Passive Infrared and Ultrasonic Occupancy Sensors
4. Daylight Sensors
5. Dimmers
6. Photocell

2.07 PHOTOCELLS

A. Low voltage photocells and day lighting sensors shall be provided where indicated.

B. Provide adjustable aperture with on/off delay feature to eliminate nuisance cycling.
PART 3 - 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. For horizontally mounted receptacles mount receptacle with neutral side Up.

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.

E. Dimmers:

1. Mount each dimmer in an individual box with ½” minimum spacing away from adjacent switches.

2. Dimmers shall be ganged where more than one occurs at a room location. Size dimmers according to the manufacturer’s derating factors. Install according to manufacturers recommendations.
   a. Provide engraving where indicated to identify the specific load controlled by the dimmer.

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.

D. Dimmers:

1. Install and wire dimmer as recommended by the manufacturer. Obtain manufacturers wiring diagrams for system applications.

2. Do not wire dimmers hot. Follow manufacturer’s instructions to avoid damage to the device.

3. Test each application to verify proper dimming and control. Correct wiring or installation where dimming of lamps is not uniform.

E. Test all devices according to code and manufacturers requirements.

END OF SECTION 16140
SECTION 16160
CABINETS

PART I - GENERAL

1.01 SUMMARY

A. Section includes:

1. Electrical equipment cabinet and enclosures.

1.02 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with Division 1, showing basic construction including metal
gauge, hinging, latch, keying, painting, and any special features such as plywood
backboards and insulation.

B. In accordance with OSHPD requirements for deferred approval items, provide structural
calculations, drawings and details for all anchorage of all secondary unit substations not
already detailed on the structural drawings. The design shall be performed by a California
registered Structural Engineer in accordance with CBC Title 24, part 2, volume 2.

1.03 REFERENCE STANDARDS

A. Underwriters Laboratory

B. NEMA

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Circle AW

B. Hoffman

C. Or Equal

2.02 CABINETS

A. Cabinets shall be constructed of code gauge steel sized as indicated on the plan or as
required for the application. The cabinet shall not have factory machine knockouts.

B. Cabinets shall be provided with barriers between signal voltage sections and power
voltage sections. All power voltage sections shall have a dead front barrier over all
terminals and live parts.

C. Doors shall be hinged, latched and lockable. Recessed mounted cabinets shall have
trims extending 1" beyond the backbox, surface mounted cabinets shall have trims flush
with the backbox. Locksets shall be keyed alike.
D. Trim shall be bonderized and painted with two coats of baked enamel ASA #61, light gray. Surface backboxes shall be painted to match. Recessed backboxes shall be galvanized.

E. Line cabinets with ½" of non-flammable foam insulation where relays, contactors or any noise generating equipment are mounted in cabinets,

PART III - EXECUTION

3.01 INSTALLATION

A. Mount cabinets rigidly to structure. Cabinets shall not depend on conduit for support.

B. Cabinets mounted on gypsum board and steel stud wall construction shall be supported from the studs.

C. Installation shall comply with all applicable seismic requirements.

END OF SECTION 16160
SECTION 16180
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - 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 2 - 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. 3M
   2. Thomas-Betts.
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. ILSCO
2. Burndy
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 3 - 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.

K. 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.

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.

END OF SECTION 16180
SECTION 16190
EQUIPMENT SUPPORTS

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 ¾" 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 16190
SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Extent of electrical identification work is as outlined by this specification.

B. Types of electrical identification work specified in this section include the following:

1. Electrical power, control and communication conductors.

2. Operational instructions and warnings.

3. Danger signs.


5. Fire stopping

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 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):

1. Brady, W.H. Company

2. Panduit Corporation
3. or equal

2.02 ELECTRICAL IDENTIFICATION MATERIALS

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, provide single selection for each application.

B. Color-Coded Plastic Tape:
   1. Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-½" wide.
      a. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.

C. Cable/Conductor Identification Bands:
   1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

D. Plasticized Tags:
   1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-¼" x 5-⅜", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.

E. Self-Adhesive Plastic Signs:
   1. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.
   2. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.
   3. Baked Enamel Danger Signs:
      4. General: Provide manufacturer's standard DANGER signs of baked enamel finish on 20-gauge steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.
F. Engraved Plastic-Laminate Signs:

1. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2. Thickness: ⅛", except as otherwise indicated.

3. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - 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 09900 of the specifications.

3. All junction and pull boxes for the fire alarm system shall be painted red. All raceway for the fire alarm system shall be labeled "Fire Alarm" in red letters on intervals not to exceed ten feet.

D. Cable/Conductor Identification:

1. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work. Refer to Section 16120 of these specifications for color coding requirements.

E. Operational Identification and Warnings:

1. Wherever required by OSHA or directed by the University, to ensure safe and efficient operation and maintenance of electrical systems, including prevention of misuse of electrical facilities equipment by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes. Request a meeting with the University prior to substantial completion to coordinate warning requirements.

F. Danger Signs:

1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations identified by the University as constituting similar dangers for persons in or about project. Request a meeting with the University prior to substantial completion to coordinate danger sign requirements.

   a. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

   b. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

G. Equipment / Device / 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 panelboards shall be on the inside of the device.

3. Panelboards, 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.

4. In addition to being individually identified, the locations of disconnect switches and other control devices mounted in and/or behind walls, ceilings, floors, and access panels or plates shall also be identified. The means of identification location shall include the device name, type, and/or use.

H. Firestopping

a. Firestopping shall be labeled at each location where installed, on each side of the penetrated fire barrier, and within 12 in. of the firestopping material.

b. Refer to the construction drawings for acceptable penetration details for use on this project.

END OF SECTION 16195
SECTION 16450
GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Power System Grounding.
   2. Electrical Equipment and Raceway Grounding and bonding.
   3. Telecommunications Systems Grounding – See Section 16745

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 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Burndy Engineering Company

B. Ilsco Corporation

C. Oz Gedney

D. Appleton.

E. or equal

2.02 MATERIALS

A. Ground Rods: Copper encased steel, ¾” 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.

E. Grounding Electrodes: As shown and as required by CEC Article 250.

F. Grounding Electrode Conductors: Bare copper underground or insulated copper aboveground and as required by CEC Article 250.

G. Bonding Conductors: Bare copper underground or insulated copper above ground and as required by CEC Article 250.

2.03 SECONDARY GROUNDING SYSTEM

A. The grounding system shall be provided as shown and shall meet the requirements of CEC Article 250. New systems shall include concrete-encased electrodes consisting of bare copper conductors placed in the bottom of the structural footings. In addition to the major components shown and required by Article 250, the grounding system shall include all fittings, connectors, devices, and material necessary for a complete and useable system. Bond the grounding system to all building columns in new construction. Bond the grounding system to all building columns as shown in existing construction.

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 minimum size 4/0 bare copper equipment grounding conductor for each of the campus utility distribution conduit banks shown on drawings. Install this equipment grounding conductor parallel to the respective conduit bank.

2.06 EQUIPMENT GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding and bonding conductors shall be separately provided and the functions shall not be combined in a single conductor.
PART 3 - 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, under slab grounding electrodes, structural footing grounding electrodes, ground rod, and grounding ring encircling the building shall all be bonded together to form a grounding electrode system per CEC Article 250.

C. Provide 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 CONCRETE - ENCASED GROUNDING ELECTRODE (UFER GROUND)

A. The UFER ground shall consist of a continuous bare copper conductor of minimum length 60' provided in the bottom of the structure foundation footing.

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 insulated green equipment grounding conductor in all conduits, including service, 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 equipment grounding conductors per CEC 250 unless a larger ground is indicated on the drawings.

C. All panelboards, junction boxes, pullboxes, wireways, device boxes, and equipment enclosures shall be bonded to the separate green equipment grounding conductor.

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. Ground motors as recommended by the VFD drive manufacturers to eliminate radio frequency interference.
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 an insulated grounding electrode conductor sized according to Article 250 of the California Electrical Code. Run the insulated conductor in rigid steel conduit.

3.06 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.

3.07 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.

3.08 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 be bronze to assure a permanent corrosion-resistant assembly. 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. Fire alarm and fire protection systems circuits and equipment shall be grounded in accordance with CEC article 250. A separate insulated green equipment grounding conductor shall be provided.

END OF SECTION 16450
SECTION 16470
PANELBOARDS

PART I - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lighting and appliance panelboards shall be rated 1200A or less.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Division 1. Include all physical dimensions, gutter space, physical construction, and list the following information:

1. Panel designation
2. Voltage rating
3. Current rating
4. Top, bottom or through feed lugs, lug size
5. Main overcurrent device size.
6. Branch device schedule, listing size and poles
7. Surface trim or recessed.
8. Fault current rating of the panel and devices
10. Bus material.
11. Indicate any special requirements including key locking, split bus, contactor panels, double panels, or panels in special NEMA enclosures.
12. Indicate which panelboards are electronic grade.

B. Operation and Maintenance Manuals: Submit in accordance with Division 1, in the following format.

1. Provide an 8-½” x 11” typewritten panel schedule for each panel, protected by a mylar jacket, and bound in a three-ring binder.

2. Schedules shall include:

   a. Panel designation.

   b. Panel location.
c. Voltage, phase, current rating.

d. Main overcurrent device size.

e. Branch circuit listing indications circuit number and description of loads served.

f. Source of panel feeder.

3. Panel schedule book shall be assembled based on "As Built" information, and submitted to the University upon completion of the project. Provide one hard copy of book and provide one CD or Zip-disk containing updated panel schedules in MS Excel format.

1.03 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA).

B. American National Standards Institute (ANSI).

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square D

2.02 PANELBOARDS - GENERAL CONSTRUCTION

A. Backbox: Code gauge galvanized steel, minimum 20" wide and 5-¾" deep, unless otherwise indicated or required. Provide gutter space in accordance with code, including additional space where required for feeder cable installations. Corners shall be lapped and riveted.

B. Interior: Provide the number of overcurrent devices and spaces as indicated on the plans and in the Panelboard Schedule. Panel bus bars shall be copper only and shall be aligned and rigidly supported on the back pan by insulators connected to a removable mounting panel. Lugs shall be sized for the wire indicated on the plan. Full length vertical buses and cross overcurrent device connection, including all hardware, shall be provided and installed for all spaces. When buss bars are not factory tapped, (all) breaker hardware must be factory mounted.

C. Neutral Bus: Double capacity of the phase bus with lugs and terminals for terminating the sizes and quantity of neutral conductors indicated and required.

D. Ground Bus: 50% capacity of the phase bus with lugs and terminals for terminating the sizes and quantity of ground conductors indicated and required.

E. Where indicated on the drawings provide isolated ground bus.

F. Trim: Cabinet front with concealed trim clamps and flush lock all keyed alike. Trim shall be dead front with metal frame index holder on inside of door. Panelboard enclosures shall be provided with either a flush or surface trim as indicated in the Panelboard Schedule, or shown on the plan. Trim shall be painted baked on ANSI #61, light gray enamel. Covers shall be hinged so that they swing away to provide full access to the interior of the panel...
without removing the cover. Covers designed for more than one panel section shall not be permitted. Hinged type door covering all circuit breakers shall be included in all panel trims.

G. Panelboard Rating:

1. Voltage and ampere rating as indicated in the Panelboard Schedule or plans.

2. Integrated or series rated devices shall not be used to meet the specified fault current levels.

3. Provide service entrance rated and labeled panelboards where required for the application.

4. Circuit breakers shall have 80% continuous rating unless indicated otherwise and shall not have continuous loads that exceeds 80% of the continuous rating. Provide 100% rated circuit breakers only where required by code or where indicated.

2.03 PANELBOARDS – 120/208-VOLT

A. Branch Circuit Panelboards:

1. Panelboards shall be bolt-on circuit breaker type with the short circuit interrupting ratings required for the available fault current.

2. Panelboards, main circuit breakers, and panel feeder circuit breakers shall be rated less than 400A and shall have a continuous rating of 80%.

3. Minimum fully rated Short Circuit Rating: 10,000-amperes rms or as shown on Drawings.

4. Circuit breakers shall be molded case, thermal magnetic trip type with common trip handle for all poles.

C. Circuit breakers shall be a minimum of 100-ampere frame. 15-ampere through 100-ampere trip size shall fit in the same pole spacing.

Provide a suitable circuit breaker, sized for the load, for each branch circuit shown on the plans, if not identified or noted in the Panelboard Schedule.

PART III - EXECUTION

3.01 INSTALLATION

A. Mount panelboards securely to the building structure. Panelboards surface mounted on steel stud and gypsum board walls shall be mounted to channel, bridging two or more studs. Installation shall comply with all applicable seismic requirements.

B. Provide spacers where panelboards are surface mounted on outside walls, to space the panel 1-½" from the wall.

C. Connect circuits shown on the plans for a balanced 3-phase load.
D. Install panelboards in conformance with NEMA PB 1.1 and manufacturer's installation instructions. Maximum mounting height - 6'-6" to top of panelboard. Panels weighing 20 pounds or more shall be installed per details on the drawings, in accordance with the CBC.

E. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of all electrical connections.

3.02 IDENTIFICATION

A. Provide a typewritten index of circuits inside the door of the panelboard. Type directing to indicate actual field installation, with odd numbering on left and even numbering on right.

B. Provide identification of ungrounded conductors according to the CEC at each branch circuit panelboard. Install permanent typewritten index similar to index of circuits.

3.03 TESTING AND ADJUSTMENT

A. Perform the short-circuit test on the overcurrent devices by simultaneously connecting the fault to each panelboard overcurrent device with the panelboard connected to its rated voltage source.

B. Method of testing per UL Standard 67.

1. Test data showing the completion of such tests furnished to the University's Representative before the submittal of approval drawings.

2. Testing of panelboard overcurrent devices for short-circuit rating only with the overcurrent devices individually mounted is not acceptable.

3. Adjust all variable trip circuit breakers to the proper setting for the load each circuit breaker is protecting. Retest to verify the setting is correct and make adjustments as needed. After the settings are completed, record the panel number, device number with the load trip point that the device has been adjusted for and the name and size of the load on a typed separate sheet of paper. Place one copy of this paper in the panel directory pocket and provide one copy with each operations and maintenance manual.

3.04 INSPECTION

A. Examine area to receive panelboards to assure adequate clearance for installation.

B. Check that walls are proper thickness for recessed panels.

C. Start work only after any unsatisfactory conditions are corrected.

END OF SECTION 16470
SECTION 16510
LIGHTING FIXTURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes
   1. Light Fixtures
   2. LEDs
   3. Egress and Exit Signs
   4. Mounting and Installation Hardware
   5. Fixture Allowances
   6. Utility Rebates

1.02 SUBMITTALS

A. Prior Approvals: Submit the following:
   1. Manufacturer’s data required to evaluate the product for which approval is sought
      including, photometric data with specified options, dimensional data, weight, and
      catalog cut sheets.
   2. A letter indicating differences between each product specified and the product for
      which approval is sought, including overall and aperture dimensional data, specified
      options available, mounting information, finishes and photometric data.
   3. Submittals which do not contain the above information will not be considered.

B. Shop Drawings: Submit in accordance with Division 1, including the following:
   1. Dimensional Drawing/Material/Finish
   2. Weight
   3. Options provided
   4. Voltage
   5. Photometric and Performance Data
   6. Ballast manufacturer and model number
   7. Lamp manufacturer and ANSI Code
   8. Mounting hardware
   9. Components that are not standard
   10. Manufacturer's Instructions: Indicate application conditions and limitations of use
       stipulated by product testing agency specified
       under “Regulatory Requirements”.
   11. Manufacturer’s Instructions: Include instructions for storage, handling, protection,
       examination, preparation, and installation of product.

C. Provide lighting shop drawings in one submittal. Include required information for all fixtures,
   lamps, and mounting hardware in shop drawing submittal. Incomplete submittals will be
   returned without being reviewed.

D. Samples.
   1. Submit a sample to the University's Representative for review when indicated on the
      Light Fixture Schedule or when a fixture is discontinued or otherwise requires
      substitution and approval after bids have been received.
   a. Submit a shop drawing, and letter stating whether the fixture is one from a
      standard factory run or a special assembly and arrange for the manufacturer’s
      representative to meet with the University’s Representative to facilitate the
      approval process at the same time as the submittal of the samples.
b. Samples will be held by the University’s Representative until completion of the approval process and then returned.

E. Submit quantity invoices for all lamps which qualify for energy rebates in accordance with Section 01700 (Contract closeout).

1.03 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of each luminaire.

1.04 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include replacement parts list.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriter’s Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.07 REFERENCE STANDARDS

A. Underwriter’s Laboratories (UL).

B. American National Standards Institute (ANSI).

C. National Electrical Manufacturer’s Association (NEMA).

D. Illuminating Engineering Society of North America (IESNA).

E. National Fire Protection Agency (NFPA).

1.08 DEFINITIONS

A. CCT: Correlated Color Temperature.

B. CRI: Color-Rendering Index.

C. LER: Luminaire Efficacy Rating.

D. Lumen: Unit of Luminous flux. Photometrically, it is the luminous flux emitted within a unit solid angle by a point source having a uniform luminous intensity of 1 candela.

E. Luminaire: Complete lighting fixture designed to distribute the light.
1.09 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

D. Comply with CEC.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.10 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire suppression system, and partition assemblies.

1.11 WARRANTY

A. Exit Signs Utilizing LED Technology: Provide manufacturer’s warranty for a period of not less than five years including parts and labor for full replacement of defective product.

B. LED Luminaires: Provide manufacturer’s warranty for a period of not less than three years for repair or replacement of defective electrical parts, including light source and power supplies.

C. Special Warranty for Emergency Lighting Batteries: Manufacturer’s standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty shall apply for the remaining six years.

PART 2 – PRODUCTS

2.01 LIGHT FIXTURES – GENERAL

A. Acceptable Manufacturers
   1. As specified in the Light Fixture Schedule.

B. Written description in the specification or in the Light Fixture Schedule indicates the desired fixture options and overrides the manufacturer’s catalog numbers given.
C. Provide all light fixtures complete with lamps, ballast drivers, and accessories required as shown on the Drawings and written schedule.

D. Provide light fixtures UL listed for through wiring with junction boxes accessible from the fixture frame-out opening for recessed fixtures installed in inaccessible ceilings.

E. Provide fixtures designed and/or gasketed to prevent light leaks from around lenses, trims and/or frames.

F. Provide lenses that are 100% virgin acrylic, .156” thick nominal, Pattern 19, unless noted otherwise in the Light Fixture Schedule.

G. Provide downlights with clear alzak cones and self-flange trims unless noted otherwise on the Drawings.

H. Provide parabolic aluminum louvers or cones designed to eliminate or provide very low iridescence when used with tri-phosphor lamps.

I. Where threaded fasteners are used for latching frames provide fasteners designed to be captive into the frames.

J. Provide and coordinate the fixture mounting accessories for all ceiling types and check ceiling finishes, clearances, structure suspension system, etc., before placing fixture orders to insure correct application. Provide fixtures with grid trim appropriate for acoustical ceiling suspension systems specified in Section 09510. Refer to architectural reflected ceiling plans and details. Coordinate with ceiling type provided by the Designer.

K. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

L. For vapor tight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonderized epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

M. Fresnel Lens and Door Assembly:
   1. Lens shall have uniform brightness throughout the entire visible area at angles from 45° to 90° from vertical, without bright spots or striations.
   2. Lens shall have opaque risers painted natural gray unless otherwise specified in the Light Fixture Schedule.
   3. Finish of regress door shall be matte black enamel paint in color as selected by the Architect.

N. For adjustable fixtures, provide positive locking devices to fix aiming angle.

O. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to CEC Article 300-22.

P. Exterior Fixtures
   1. Provide exterior fixtures with clear tempered glass lenses unless indicated otherwise in Light Fixture Schedule.
   2. Provide a minimum 2.5 mil thick baked on polyester powder finish, color as specified in the Light Fixture Schedule for exterior fixture housing and poles.
   3. Provide fully gasketed exterior fixture lens and diffuser frames to prevent moisture, debris, and insects from entering the fixture housing.
4. Painted surfaces shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion.
5. Finishes to comply with requirements set by the American Architectural Manufacturers Association (AAMA):
   a. Baked on enamel and high performance powder coating finish on aluminum:
   b. AAMA 304-05
   c. Anodized aluminum AAMA 611-98
   d. Clear coat on aluminum: AAA 612-02
6. Finish colors shall be as specified.

2.02 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A
B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent electric light sources from causing false turnoff.
   1. Relay with locking-type receptacle shall comply with ANSI C136.10.
   2. Adjustable window slide for adjusting on-off set points.

2.03 LIGHT EMITTING DIODE (LED) FIXTURES:

A. LED sources must meet the following requirements:
   1. Operating temperature rating must be between -40°C and +50°C.
   2. Correlated Color Temperature (CCT):
      a) Du’v’ tolerance of 0.001 ± 0.006
B. Color Rendering Index (CRI): greater than or equal to 80.
C. Luminaire manufacturer must submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:
   1. High Temperature Operating Life (HTOL)
   2. Room Temperature Operating Life (RTOL)
   3. Low Temperature Operating Life (LTOL)
   4. Powered Temperature Cycle (PTMCL)
   5. Non-Operating Thermal Shock (TMSK)
   6. Mechanical Shock
   7. Variable Vibration Frequency
   8. Solar Heat Resistance (SHR)

2.04 LED DRIVERS/POWER SUPPLIES

A. LED drivers must meet the following requirements:
   1. Drivers must have a minimum efficiency of 85%.
   2. Starting Temperature: -40°C.
   3. Electrical Characteristics:
      a. Volts: as indicated on Luminaire Schedule.
      b. Phase: Single.
      c. Hertz: 60.
   4. Power supplies can be UL Class I or II output.
   5. Drivers must have a Power Factor (PF) of greater than or equal to 0.90.
   6. Drivers must have a Total Harmonic Distortion (THD) of 20% or less.
   8. Drivers must be Reduction of Hazardous Substances (RoHS) compliant.
9. Drivers must comply with requirements in Section 2.5 B Controls.

2.05 LED LUMINAIRE

A. Provide luminaires with integral LED thermal management system (heat sinking).

B. Luminaires shall be equipped with an LED driver that accepts 120V through 277V, 50hz to 60hz (UNIV). Component-to-component wiring within the luminaire will carry no more than 80% of rated current and be listed by UL for use at 600 VAC at 302°F/150°C or higher. Plug disconnects shall be listed by UL for use at 600 VAC, 15A or higher.

C. LED modules shall have a minimum L70 service life of 75,000 hours at 25°C ambient temperature and based on IESNA LM-80 methodology.

D. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire. Luminaires requiring removal or replacement of entire luminaire to access LEDs and drivers will NOT be accepted.

E. Luminaires shall be listed by Design Lights Consortium.

F. Housing: Rigid aluminum construction.


H. Lamp holder housing: Cast aluminum with integral heat radiating fins to assure cool lamp base operation, with sufficient heat dissipation to meet device manufacturer’s guidelines, certification programs, and test procedures for thermal management.

I. Off-state Power: Luminaires shall not draw power in the off state. Exception: Luminaires with integral occupancy, motion, photo-controls or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

2.06 LED DIMMERS

A. Provide dimmer and driver that are compatible and tested to comply with UL standards.

B. Continuous Flicker Free dimming range 100% to 1% measured relative light output. Relative humidity: maximum 90% non-condensing.

C. Power factor: greater than .90 at 25W.

D. Total Harmonic Distortion: less than 20% at 25W.

E. Inrush current: <2A.

F. Sound rating: Inaudible in a 24 db ambient.

G. Class P thermally protected.

H. Meets FCC Part 15 Non-Consumer requirements for EMI/RFI emissions in a typical grounded fixture.
I. Provide dimmers with Pulse Width Modulation for both constant current or constant wattage drivers to maintain LED color when dimming. Unless noted otherwise on the Luminaire Schedule.

2.07 WIRING

A. Wiring shall be as required by code for fixture wiring.

B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

C. Flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 105°C.

D. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

E. No internal wiring shall be visible at normal viewing angles, i.e. above 45° from vertical.

F. Provide #18 AWG, 3-wire flexible conduit connections (whips) for dual level switching as shown on Drawings for light fixtures recessed in accessible suspended ceilings. Provide 3-wire whips for all dual level switching. Wire count on wire whips is not shown on Drawings and shall be the responsibility of the Contractor to provide proper wire count for the lighting controls as shown on Drawings.

2.08 EXIT LIGHTS/EXIT SIGNS

A. Acceptable manufacturer:
   1. As specified in Light Fixture Schedule.

B. Provide cast aluminum stencil face Exit Signs with fully concealed chevron type directional arrow knockouts and universal mount canopy unless otherwise indicated on the drawings.

C. Provide exit lights illuminated from light emitting diodes (LED) designed so that individual LEDs cannot be seen when the exit light is installed and illuminated.

D. Provide canopy, housing, stencil face and flange trim with white high temperature or polyester powder coat painted finish.

E. Letters shall be Red.

F. Do not install exit signs that utilize radioactive Tritium (³H) gas to provide illumination.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install suspended exit signs using stem pendants from swivel hangers.

C. Install suspended luminaires using stem pendants from swivel hangers, aircraft cable, and chain in accordance with the intended design. Provide stem pendants, aircraft cable, and chain lengths required to suspend luminaire at indicated height.
D. Provide mounting accessories and trims as required for wall and ceiling construction types shown in Finish Schedule and on Drawings.

E. Lighting Fixtures:
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated. Secure to prohibit movement.
   2. Install lamps in each luminaire.

F. Temporary lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

G. Verify weight and mounting method of fixtures and provide suitable supports. Fixture mounting assemblies shall comply with local seismic codes and regulations.

H. Support luminaires larger than 2’ x 4’ size or heavier than 56 pounds independent of ceiling framing.

I. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Refer to architectural reflected ceiling plans for coordination of lighting fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Architect prior to installing any of the systems.

J. Install recessed luminaires to permit removal from below.

K. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

L. Install clips to secure recessed grid-supported luminaires in place.

M. Install fixtures with vent holes free of air blocking obstacles.

N. Lighting fixtures located in recessed ceilings with a fire resistive rating of 1-hour or more shall be enclosed in an approved fire-resistive rated box equal to that of the ceiling.

O. Adjust aperture rings on all recessed fixtures to be flush with the finished ceiling.

P. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.

Q. Install accessories furnished with each luminaire.

R. Install wall mounted luminaires and exit signs at height as indicated on Drawings.

S. Blemished, damaged or unsatisfactory fixtures or accessories shall be replaced.

T. For pendant mounted fixtures, mounting height is from finished ceiling to top of pendant light fixture. For wall mounted fixtures, center on outlet box unless otherwise noted. Verify mounting provisions and other requirements prior to order of light fixtures and provide as required.

U. In accessible suspended ceilings, provide 72” flexible conduit wiring connection (flexible tubing not permitted) from a rigidly supported junction box.
V. Bond products and metal accessories to branch circuit equipment grounding conductor.

W. All finishes shall be unmarred upon project completion. Repair or replace damaged finishes.

X. Install specified lamps in each luminaire.

Y. Replace all burned out or inoperative lamps at the end of the construction prior to Owner occupancy.

Z. Install continuous row fixtures as shown of drawings. The fixture type letter next to one fixture identifies all fixtures in the row. Rows are made up of either 4’ or 8’ long lamps in combination to complete the row. Design-Builder shall be responsible for quantities of fixtures required in any row and for supplying fixtures which are an interior continuous mounting or a fixture with end cap. The channels or fixtures may be longer than 4’, but plastic lenses, hinged doors and louver sections shall not exceed four feet long.

AA. Install concrete bases for exterior fixtures except parking lot fixtures with top of base flush with finished grade or as detailed on the Drawings. Install concrete bases for parking lot fixtures a minimum of 30” above paving to top of base or as detailed on the Drawings.

BB. Clean fixtures immediately before the final inspection. Provide fixtures newly lamped and in perfect operating condition at the completion of the job.

3.02 SUPPORT OF LED LIGHT FIXTURES

A. Recessed type: For light fixtures supported by the ceiling suspension system, provide four Caddy #515 (or as provided by the manufacturer) support clips (one each corner) which lock light fixture to ceiling tees after light fixture is installed. In addition, provide for each light fixture two #14 earthquake chains or #12 wires secured at diagonally opposite fixture corners (for fixtures weighing less than 56 pounds) to structural members above suspended ceiling. For plaster or gypsum board ceilings provide plaster frame compatible with light fixture. Contractor shall coordinate fixture trim with ceiling type.

B. Surface Mounted Type:
   1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
   2. Continuous Runs of Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.

C. Pendant Mounted Type:
   1. For fixtures with rigid pendants, supply swivel ball aligners at canopy to comply with local seismic requirements.
   2. Where suspended from accessible ceiling, support fixture from structural members above ceiling by means of hanger rods through ceiling or as accepted.
   3. Continuous Runs of Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.
   4. Where pendant is longer than 48 inches (1200 mm), brace to as required by code or shown on Drawings.

3.03 DIFFUSERS AND ENCLOSURES

A. Remove protective plastic covers from lighting fixture diffusers only after construction work, painting and clean-up are completed. Remove all dirty lamps, reflectors and diffusers; clean and reinstall. When cleaning “Alzak” reflectors, use a manufacturer recommended cleaning
solution. Reflectors damaged or impregnated with fingerprints shall be replaced at no cost to Owner.

B. For LED fixtures, whether surface mounted or recessed, remove all construction dirt and dust from heat sink fins to insure proper dissipation of heat.

3.04 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 12 hours at full voltage per NEMA recommendations or as required by fixture manufacturer.

3.05 ADJUSTMENT OF LIGHT FIXTURES

A. Aim and adjust luminaires as indicated on drawings.

B. Provide materials and labor for aiming and adjusting lighting fixture under Architect’s supervision. Aiming and adjusting shall take place immediately before building is turned over to Owner.

C. Adjust exit sign directional arrows as indicated.

D. Re-lamp luminaires that have failed lamps at substantial completion.

E. Provide all new lamps burned in for 100 hours.

3.06 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Inspect each installed fixture for damage. Replace damaged fixtures and components.

F. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photometric controls.

G. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance to standards.

3.07 DEMONSTRATION

A. Provide a minimum of two hours demonstration of luminaire operation.

3.08 ENERGY REBATES
A. Submit quantity invoices for all lamps and ballasts which qualify for energy rebates. Apply for all applicable lamp and ballast energy rebates.

B. Retain samples of existing lamps and ballasts as proof of energy savings when required by the energy utility for rebate.

C. Coordinate with the electrical utility to facilitate rebate payments to be made directly to the Owner.

D. Use of lamps and ballasts not eligible for rebates must be approved by the Owner prior to implementing the design.

END OF SECTION 16510
SECTION 16700
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not necessarily limited to:
1. Common standards and procedures for the Communications Work.
2. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Communications Systems. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

B. Provisions of this Section apply to Communications Work, including the following Sections:
1. Section 16705 – Grounding and Bonding for Communications Systems
2. Section 16710 – Hangers and Supports for Communications Systems
3. Section 16712 – Conduits and Backboxes for Communication Systems
4. Section 16714 – Cable Trays for Communication Systems
5. Section 16740 – Identification for Communications Systems
6. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
7. Section 16765 – Communications Termination Blocks and Patch Panels
8. Section 16770 – Communications Cable Management
9. Section 16960 – Electrical Equipment Acceptance Testing

1.2 RELATED WORK BY OTHERS

A. By the Base Building Construction Contract.
1. Provision of Telecommunications room cable tray, power, riser conduit, horizontal conduit, work area outlet rough-in, in ceiling void basket tray where indicated, sleeves, floor boxes and other Telecommunications pathway for use by the work of this project.
2. Establish proper spacing between closets and maintain UC defined distance requirements
3. Room and space, minimum dimensions of a 10 foot by 15 foot area for IT floor mounted free standing equipment racks. Front and rear access is to be provided, side access in not required. Provide additional space(s) as requirements develop and customer requirements are refined.
4. Telecommunications and AV systems equipment shall not be housed in the same spaces or rooms.
5. Backboards in Telecommunications Rooms.
6. Engineering or architectural group shall provide cable numbers to UC representatives specification on all new construction projects.
7. Engineering or architectural group shall provide schedule for cable and room number in excel format.
8. Engineering shall provide a minimum of a 2 ton cooling per IT dedicated space.
Additional cooling shall be provided as additional heat load is identified.

9. HVAC shall be independent of the building controls and available 24 X 7.

10. Provide split units where applicable.

11. HVAC shall have the ability to be monitored, and be engineered to provide this service.

1.3 REFERENCES

A. Usage: In accordance with Section 01410 – Regulatory Requirements.

B. American National Standards Institute (ANSI)

1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009

2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009


1.4 DEFINITIONS

A. See also Section 01420 - References

B. General Abbreviations used in these specifications. Refer additionally to the abbreviations list appearing on the Drawings.

1. ADA Americans With Disabilities Act

2. AFC Above Finished Ceiling

3. AFF Above the Finished Floor

4. BDF Building Distribution Frame – see Telecommunications Rm. description below

5. BLDG Building

6. CAT Category

7. CD Campus Distributor – see Telecommunications Rm. description below

8. CL Centerline

9. dBm Decibel Power Level reference

10. DIV Division

11. (E) Existing

12. ER IT Equipment Room

13. FBU Furnished By University

14. FD Floor Distributor – see Telecommunications Rm. description below

15. GE Grounding Equalizer – Part of the Telecommunications Grounding System

16. HR Home Run

17. ID Inside Diameter

18. IDF Intermediate Distribution Frame – see Telecommunications Rm

19. LAN Local Area Network

20. MAX Maximum

21. NIC Not In Contract

22. OD Outside Diameter

23. PSRH Project Standard Receptacle Height

24. PSSH Project Standard Switch Height

25. TBB Telecommunications Bonding Backbone – Part of the
Telecommunications Grounding System

26. TGB Telecommunications Ground Busbar
27. TMGB Telecommunications Main Ground Busbar
28. TR Telecommunications Room – see Communications Room description below – these terms are used interchangeably in this document
29. TYP Typical
30. UFE University Furnished Equipment
31. UON Unless Otherwise Noted

C. Electrical and electronics terms used in the Communications Sections shall be as defined in:

1. ANSI/TIA/EIA-568-C.0
2. ANSI/TIA/EIA-568-C.1
3. ANSI/TIA/EIA-568-C.2
4. ANSI/TIA/EIA-568-C.3
5. ANSI/TIA/EIA-569-B
6. ANSI/TIA/EIA-606-A, ANSI/TIA-606-B
7. IEEE Std 100
8. This Section.

D. Campus Distributor (CD) - A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

E. Building Distributor (BDF) - A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

F. 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.

G. 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.

H. Room (ER) (Telecommunications) - A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

I. Open Cable - Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is open to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

J. Open Office - A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

K. Pathway - A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.5 SUBMITTALS

A. Comply with Section 01330 – Shop Drawings, Product Data and Samples and the following.

1. Submit all materials for review arranged in same order as Specifications, individually referenced to Specification Section, Paragraph and Contract Drawing number. Conform in every detail as applies to each referencing Section.

2. Submit 8 ½”x 11” items bound in volumes and drawings in edge bound sets. Submit all drawings on sheets of the same size.
3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.

4. Progress Schedule: Comply with Section 01320 - Contract Schedules.

B. Contractor and Key Personnel Experience.
   1. A minimum of 30 days prior to installation, submit documentation of the experience of the low voltage systems, equipment and infrastructure contractor(s) and of their key personnel.
   2. Qualifications shall be provided for:
      a. the low voltage systems, equipment and infrastructure contractor(s),
      b. the low voltage systems, equipment and infrastructure installers,
      c. and the supervisor(s) (if different from the installers).
   3. Refer to Quality Assurance paragraph in this section for complete requirements.

C. Manufacturer's Product Data:
   1. Manufacturer's Product Data Sheets. Collate in sequence of List of Materials:
   2. Data sheet for each item in each Communications Section, including all accessories, clearly marked for proposed product.
   3. Safety Data Sheet, where applies.
   4. List of Materials Schedule. For each item, include:
      a. Referencing Specification Section
      b. Referencing Paragraph
      c. Referencing Drawing, if specified only on plans
      d. Manufacturer.
      e. Model number.
      f. Listing, including name of Nationally Recognized Testing Laboratory.
      g. Precede each submittal book with a summary schedule, with columns for each item above and rows for each item submitted, per the example schedule below:

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Paragraph</th>
<th>Contract Drawing Reference</th>
<th>Manufacturer</th>
<th>Model No.</th>
<th>UL/CLA Listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>16700</td>
<td>2.03 C.</td>
<td>XYZ</td>
<td>123</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>16715</td>
<td>2.07 A. 1.</td>
<td>AAA</td>
<td>34-56</td>
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<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L-T7.2</td>
<td>ZZY</td>
<td>456</td>
<td>Y</td>
</tr>
</tbody>
</table>

D. Field (Installation) Drawings:
   1. General
      a. Drawings shall present the proposed installation using the makes and models of devices proposed for use this project; if “equal” is used in bid set replace with the actual part numbers to be installed or provide a lookup table in the drawings to permit determining the actual part number.
      b. Where the existing systems and/or infrastructure are used and integrated into the work of the project, indicate them on drawings, including points of interface and demarcation of existing and new work.
      c. Collate, in sequence, at least the following minimum drawings, for each infrastructure and system to be installed under the work of this contract:
   2. Drawing index/symbol sheet.
   3. Site plans, floor plans and reflected ceiling plans.
      a. General
         i. The identifier for each termination and cable shall appear on the drawings, either directly on the floor plans, through an associated schedule or a unique identifier associated with a fully annotated single line diagram.
ii. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

iii. At scale of Contract Documents, show:
   1. Device locations and type
   2. Rough-in.
   4. Conduit size.
   5. Basket tray routes or equivalent means of support used by the work of this project.
   6. J-hook routes
   7. Wire type.
   8. Wire fill.

iv. On the floor plans, indicate floor and wall mounted devices and pathway below a height of 7 feet above finish floor. Indicate the locations of the Telecommunications rooms and provide reference to the enlarged Telecommunications rooms plans.

v. On the reflected ceiling plan, indicate ceiling and wall mounted devices and pathway above a height of 7 feet above finish floor. Indicate the locations of the Telecommunications rooms and provide reference to the enlarged Telecommunications rooms plans.

b. Communications Infrastructure

i. Provide Registered Communications Distribution Designer (RCDD) approved, drawings depicting a complete communication infrastructure in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the Telecommunications rooms including EF, ER, CD's, BD's, and FD's to the Telecommunications work area outlets.

ii. The following drawings shall be provided as a minimum:
   1. T1- Layout of complete building per floor - Backbone and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of Telecommunications rooms, physical access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.
   2. T-2 Serving Zones/Building Area Drawings - Drop Locations. Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.
4. Enlarged Plans
   a. General
      i. Indicate at least as much information as is provided in the Contract Documents, supplemented by the dimensions and arrangement of the proposed equipment, trade coordination and field conditions.
   b. Communications Infrastructure.
      i. Telecommunications Room Drawings
         (1) Provide T3 drawings in accordance with EIA TIA/EIA-606-A that include Telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Include rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.
         (2) At scale of Contract Documents, the Contractor shall submit scaled drawing elevations (showing dimensions, mounting locations and associated frames & equipment) for all required assemblies, including but not limited to:
            a) Rack locations
            b) Wall mounted plywood backboards
            c) Wall mounted backbone cabling and major station cable bundles.
            d) Wall mounted and tray mounted splice cases
            e) Wall mounted copper cable protectors and terminal blocks.
            f) Wall mounted fiber optic cable terminations.
            g) Clearances
            h) Backboard Wire and Cable Management
            i) Rack elevations, including
               j) Copper cable patch panels.
               k) Fiber optic cable patch panels.
               l) Rack mounted wire managers
               m) Hold clears for equipment provided by Others.
               n) Reference to mounting details.
               o) Power strips & PDU’s
               p) Rack Mounted UPS
      ii. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

5. System Riser Diagrams,
   a. General:
      i. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.
      ii. Single line diagram of structured wiring
      iii. Grounding and bonding scheme
      iv. Terminal cabinets.
      v. Coordination with floor plans.
      vi. Wire runs not shown on floor plans.
      vii. Wire type.
      viii. Wire fill.
ix. Interface to work provided by work of other Sections, University Furnished Equipment, existing equipment and/or future equipment.

x. For Audiovisual Systems, including MATV Systems, Audiovisual Systems and and Public and mass Notification Systems, indicate digital or analog signal type and voltage levels (dBmV, microphone, line live, speaker level) or optical signal levels.

6. Detail Drawings

a. Mounting details:
   i. Specific details of restraints including anchor bolts submitted under the Section 16710 – Hangers and Supports for Communications Systems for mounting and maximum loading per assembly, showing compliance and coordination with Code and the project Architectural, Structural and Mechanical Documents.
   
i. Stamped and signed by a Professional Engineer licensed in the Project jurisdiction for work of this type.
      (1) Submit an accompanying Engineering analysis stamped and signed by an Engineer licensed in California for work of this type, indicating that the Equipment Enclosure System will comply with California Building Code for the Project Seismic Zone when loaded with the weight of the equipment submitted as well as the University's proposed equipment intended for installation in the racks installed under the work of this Project.
      (2) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
   ii. Show loads, type and strength of connections, sizes, dimensions, materials, etc.
   iii. Provide details for:
      (1) Equipment Rack anchorage.
      (2) Wall Mounted Racks and Enclosures.
      (3) Cable Runway and Cable Tray
      (4) Wall and ceiling loudspeakers weighing 20 pounds or more.

b. Faceplate and Receptacles
   i. Receptacle and jack arrangement for each condition.
   ii. Labeling of receptacle/jacks and plate
   iii. Plate material.
   iv. Plate finish.
   v. Connector types.
   vi. Connector dimensioned layout.

c. Pathway
   i. Fire stopping
   ii. Cable tray installation details, indicating complete system of fittings and radiussed pathways provided.
   iii. Details of flexible raceway connections to be made to vibrating equipment
   iv. Details of J-Box and a schedule of rooms to receive application of mastic and sealant at J-Boxes
   v. An itemized list of all items of equipment to be fitted with flexible electrical connections.
   vi. Conduit racking details.


e. Terminal cabinets: Terminations.
f. Voice cable plant: Cut sheets for use by University's Telephone Systems Contractor

E. Samples: Samples for review by the University's Representative of all finishes/materials which will be visible to the public, including but not limited to:
   1. Receptacles. The Contractor shall submit a mock up sample of each type of communication outlet including conduit, wall box, faceplate, communication cables, jacks and jack identifying labels.
   2. The Contractor shall submit a sample of each type of label to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.
   3. Surface Raceway, for each type:
      a. Raceway base and cover, at least 5 foot section.
      b. Boxes, at least two of each type to be used.
      c. For other items, provide at least 2"x 2" sample.

F. Test Plan
   1. Submit complete documentation of the proposed test plan and equipment to be used to document that the performance of the cabling, equipment, sub-systems and complete systems installed under the work of this project conform with the performance standards outlined in each specification section.
   2. Submit not less than 45 days prior to the proposed test date. Include procedures for certification, validation, and testing.

G. Test Reports
   1. Project Site Test Reports:
      a. Submit following system completion and prior to and as condition precedent to Acceptance Review and Testing of the Work of this Section.
      b. Schedule: Submit test reports in timely manner relative to Project schedule such that the University’s Representative may conduct verification of submitted test data without delay of scheduled progress.
      c. Project Site test report:
         d. Content: Include at least:
            i. Time and date of test.
            ii. Personnel conducting test.
            iii. Test equipment, including serial and date of calibration.
            iv. Test object.
            v. Procedure used.
            vi. Results of test
            vii. Numerical or graphical presentation.
      e. Submit copy of final results on paper and in electronic form. This shall be organized by cable ID number for the circuit under test, consistent with circuit numbering scheme used in preparing submittal drawings and in labeling receptacles and terminations.
         i. Submit machine-generated documentation and raw data of all test results in electronic form on CD-R or DVD media.
         ii. Submit machine-generated documentation of all test results in printed form organized in binders for each category of test performed

1.6 QUALITY ASSURANCE

A. Contractor Firm and Personnel Qualifications:
   1. General:
      a. Communications Infrastructure work shall be performed by and the equipment shall be provided by the low voltage communications systems and infrastructure contractor and that contractor's key personnel.
b. Be a Panduit Corp. PCI (Panduit Certified Installer) Design and Installation Contractor or approved equal

c. Contractor:
   i. The low voltage communications systems and infrastructure contractor for each section of the work of this Project shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified low voltage communications systems, equipment and infrastructure.

   ii. The low voltage communications systems and infrastructure contractor shall list two years or equivalent experience in a hospital environment.

   iii. The low voltage communications systems and infrastructure contractor shall demonstrate experience in providing successful data infrastructure systems within the past 3 years.

      (1) Submit documentation for a minimum of three and a maximum of five successful low voltage communications systems and infrastructure system installations for each low voltage communications systems and infrastructure contractor.

   iv. The low voltage communications systems and infrastructure contractor shall demonstrate experience in providing successful low voltage communications systems and infrastructure within the past 3 years.

   d. Key Personnel

   i. 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. Each of the key personnel shall demonstrate experience in providing successful low voltage communications systems, equipment and infrastructure within the past 3 years.

   ii. 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.
iii. 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 3 years experience in the installation of the specified copper and fiber optic cable and components. The personnel on site preforming 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. Submit documentation for a minimum of three and a maximum of five successful cabling system installations for each of the key personnel. 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. 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. 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. Indicate that all key persons are currently employed by the low voltage contractor, or have a commitment to the low voltage contractor to work on this project. All key persons shall be employed by the low voltage contractor at the date of issuance of this project, or if not, have a commitment to the low voltage contractor to work on this project by the date that the bid was due to the University's Representative.

2. Note that only the key personnel approved by the University'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 low voltage contractor's key personnel requires approval from the University's Representative.

iv. 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.

v. 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.
(1) 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.

(2) 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.

(3) 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.

B. Standard Products

1. General
   a. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship.
   b. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
      i. Alternative Qualifications. Panduit Factory Certification
   c. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the specifying section.

2. Material and Equipment Manufacturing Date
   a. Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

3. Minimum Communications Infrastructure Manufacturer Qualifications
   a. Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with ANSI/TIA/EIA-568-C.0, ANSI/TIA/EIA-568-C.1, ANSI/TIA/EIA-568-C.2 and ANSI/TIA/EIA-568-C.3.

C. Reference Documents

1. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies.
   a. A complete set of the latest stamped, actioned submittals of record.
   b. A complete set of manufacturer's original operation, instruction and service manuals for each equipment item.
D. Test Equipment
1. Requirements:
   a. Maintain and operate test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section.
   b. Maintain test equipment at the job site while work is in progress from installation of equipment racks until University Acceptance of this Work; thereafter remove all of this test equipment from the job site.
   c. Unless otherwise indicated, test equipment shall remain property of the Contractor.
   d. Provide all required test cables, jigs and adapters.
   e. Provide equipment with traceable calibration, with calibration date not greater than one year prior to the date of the use of the equipment to perform the specified testing.

1.7 REGULATORY REQUIREMENTS
A. Regulations Applicable: Including but not limited to those defined in Section 01410 - Regulatory Requirements.
   1. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, or regulations.
   2. Safety Agency Listing: All devices provided under the Work of this Section which are connected to the Project electrical system shall be listed by a Nationally Recognized Testing Laboratory, and shall be so labeled.
   3. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the University's Representative. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.8 DELIVERY, STORAGE AND HANDLING
A. Procedures:
   1. In accordance with Section 01610 – Product Requirements and as specified in the individual sections of Division 16.
B. General
   1. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.9 ENVIRONMENTAL REQUIREMENTS
A. Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.10 SEQUENCING
A. Comply with Section 01110 - Summary of Work, Section 01320 – Contract Schedules and the following.
   1. Sequence.
      a. If there are any modifications to the bid documents, the University will provide the Contractor copies of the Contract Drawings showing station outlets with final University assigned backbone cable and horizontal jack and cable ID numbers in the following form.
   2. Reproducible:
      a. CAD files: 1 set.
3. Contractor to use these numbers in preparing their shop drawings and in executing the work of the Project.

1.11 OPERATING AND MAINTENANCE DATA

A. Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the low voltage systems, equipment and infrastructure work of this Project. Precede the manuals with a systems narrative specific to this Project, outlining the major systems functionality, the major systems components, and identifying which manuals document the performance of which subsystems.

1. Submit operations and maintenance data in accordance with Section 01780 - Closeout Submittals and as specified herein not later than 2 months prior to the date of beneficial occupancy.

1.12 PROJECT RECORD DOCUMENTS

A. Comply with Section 01780 - Closeout Submittals and the following. Include at least as much information as required for the submittal drawings.

1. Record Drawings
   a. Content, General
      i. Contractor shall be responsible for updating building and communications plans to reflect as-built and as-installed conditions including any additions, changes or deletions.
      ii. Indicate actual work on Drawings; indicate actual products used, replace vendor neutral nomenclature used in bid set with makes and models of actual installed devices.
      iii. Record drawings are to be updated depicting the cables used and the new designations resulting from the installation.
      iv. Record drawings are to be updated on the University's campus outside plant communications map when applicable. The University's representative will provide a copy of the current file for the Contractor to update - the content of which may differ from the simplified form used in the contract documents.
   b. Additional Content, Low Voltage Cabling Infrastructure
      i. Provide drawings including documentation on cables and termination hardware in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B. Drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum.
      Provide the following drawing documentation as a minimum:
      (1) Cables - A record of installed cable shall be provided in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B. Include manufacture date of cable with submittal.
      (2) Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B. Documentation shall include the required data fields as a minimum in accordance with ANSI/TIA/EIA-606-A, ANSI/TIA-606-B.
(3) WAP location CAD drawing showing AP name color coded with blade # (blue blade 1, orange blade 2, green blade 3, brown blade 4, slate blade 5, aqua blade 6, rose blade 7, Violet blade 8, etc.) alternating ports allocated for full redundancy designated by installer shall be illustrated on a CAD print immediately following the installation and provided to the University.

(4) Where work of this project installs University furnished wireless access points, provide the complete color coded drawing and spreadsheet connectivity documentation required under Section 16740 - Identification for Communications Systems.

c. CAD.
   i. Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Digital files shall be CAD system files in AutoCAD®.DWG format, latest version at time of bid. (University Standard, no substitution permitted).
   ii. Except where prohibited by Contract, University’s Representative will furnish CAD backgrounds in AutoCAD®.DWG format, for use by the Contractor in preparing Record Drawings.
   iii. Disk copy of Record Drawings: Provide 2 separate media copies of each drawing file in the format noted above. Submit on CD-R, DVD-R disk, or USB Flash Drive Memory media.

d. Reproducibles: As required in Section 01780.

C. PANGEN™ 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.
1.14 ACCEPTANCE REVIEW AND TESTING PROCEDURES

A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawings. Notify the University’s Representative in writing that the Work of these Sections is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing. The University's Representative will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These procedures may be performed at any hour of the day or night as required by the University's Representative to comply with the Project Schedule and avoid conflict with Residents. Provide all specified personnel and equipment at any time without claim for additional cost or time.

B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.

C. In Addition, Provide:
   1. All tools appropriate for performance of adjustment of and corrections to this Work. Include spare wire and connectors and specified tooling for application.
   2. Ladders, scaffolding and/or lifts as required to access high devices.
   3. All test equipment.
   5. Complete set of Test Reports.
   6. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.
   7. Demonstrate: Complete operation of all systems and equipment, including Portable Equipment.
   8. Adjust: As directed by the University's Representative.
   9. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the University’s Representative.

D. Facilities Acceptance, Infrastructure turn over: Confirm all construction work is complete within the confines of the scope of work and physical construction area. All work within the confines of the IT TR/IDF/BDF’s is to be completed. No subsequent cutting, drilling, sawing, sanding, painting, or installations is to occur and the area is to be professionally cleaned.

1.15 CLOSEOUT

A. In addition to provisions of 01780 – Closeout Submittals, Warranties and Guarantees, Project turn over, provide the following:

   1. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify the University’s Representative of completion of Punch List.
   2. Portable Equipment: Furnish all portable equipment and spares to the University's Representative, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.
   3. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.
   4. Project Record Documents: Submit print and digital copies. Digital files shall be CAD system files in AutoCAD®.DWG format, latest version at time of bid. (University Standard, no substitution permitted) as defined above.
5. Keys: If applicable, replace construction locks with permanent locks. Provide 5 sets of keys to the University's Representative.

6. Instruction: Conduct specified instruction. Schedule a final walk thru to provide verification of punch list items completed, final closet clean, and documents within.

7. Warranty: Submit Warranty dated to run from date of Acceptance of the Work of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.

B. Each material, device or piece of equipment shall comply with all of the manufacturer's current published specifications for that item.

C. Products shall be made by manufacturers regularly engaged in the production of such products.

D. Provide quantity as shown on Contract Drawings, or as otherwise indicated.

E. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.

F. Unless recycled content is specified, provide new materials.

G. Provide the manufacturer's latest design/model, permanently labeled with the manufacturer's name, model number and serial number.

H. Where products are of similar type or use, provide products of the same manufacturer, unless otherwise indicated.

I. Components

1. UL or third party certified. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance.
   a. The label or listing by the specified organization will be acceptable evidence of compliance.
   b. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the University's Representative.
   c. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

J. Enclosures:

1. Provide steel frames and enclosures designed and wired to eliminate all induced currents.

K. Finishes: Any item or component of the Work of this Section which is visible shall comply with the following.
1. Finishes noted or scheduled on the Contract Drawings take precedence.
2. Where design location requires that products, materials or equipment are visible to the public, no manufacturer's logos larger than 1/2 inch shall be visible. Unless otherwise noted or directed, neatly remove or permanently paint out such logos.
3. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the University's Representative.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine existing conditions before starting work. Submit conflicts in a timely manner for resolution

3.2 WIRING CLASSIFICATION AND RELATED
A. Audio Signal Wiring Classification:
1. Type A-1: Microphone level wiring less than -30 dBu, 20 Hz to 20 kHz.
2. Type A-2: Line level wiring -30 dBu to +24 dBu, 20 Hz to 20 kHz.
3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBu, from 20 Hz to 20 kHz.

B. Video and Related Signal Wiring Classification:
1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 10.0 MHz.
2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.
3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.
4. Type V-4: MATV system wiring 0.1 to 1000 microVolts peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.

C. Control Signal Wiring Classifications:
1. Type C-1: DC control wiring 0 to 50 volts.
2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

D. Additional Wiring Classifications:
1. Type M-1: DC power wiring 0 to 48 volts.
2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.
3. Wiring Combinations:

E. Except as indicated herein, conduit, wireways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Drawings.
1. Types A-1, C-1, and M-1.
2. Types A-2, C-1, C-2, and M-1, runs less than 20 feet.
3. Types A-2, C-1, and M-1.
4. Types A-3, C-1, C-2, and M-1.
5. Types A-2, V-1, and V-3.
6. Types V-1, V-2, V-3, and C-1.
7. Types M-2 and C-3.
3.3 **PREPARATION**

A. Prepare and sequence the work to minimize disruption to each room environment and existing communications systems.

B. Protection: Cover all computers, electronic equipment, desks, chairs, furniture and other articles when working at ceiling level and/or performing dust producing tasks.

3.4 **REPAIR AND RESTORATION**

A. Where working in spaces occupied by the University, return to their original positions any furniture or articles relocated to perform the work.

3.5 **CLEANING**

A. Where working in spaces occupied by the University:

1. Immediately after completing work within each space, clean up and remove all materials, scrap and dust.

2. All scrap material in work area shall be picked up and removed from the building at the end of each day. See also Section 01780 – Closeout Submittals for additional requirements.

3. All dust resulting from work performed shall be vacuumed up daily.

4. All scrap material shall be removed from Campus and disposed of in an authorized disposal site. Refer to Section 01740 – Cleaning.

5. Telecommunications Room clean-up shall be performed at the time of Turn-over.
   a. Thorough Vacuuming and wipe-down of all surfaces.
   b. All unused materials removed.
   c. Professional cleaning services.

END OF SECTION 16700
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section includes grounding and bonding of Communications Work, including but not limited to:
   1. Cable Shields
   2. Protector Fields
   3. Communications racks, cabinets and enclosures.

B. Related Work Under Other Sections
   1. Section 16450 – Grounding
   2. Section 16700 – Common Work Results for Communications
   3. Section 16710 – Hangers and Supports for Communications Systems
   4. Section 16740 – Identification for Communications Systems
   5. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
   6. Section 16765 – Communications Termination Blocks and Patch Panels
   7. Section 16770 – Communications Cable Management

1.2 SYSTEM DESCRIPTION

A. Provide Telecommunications Grounding System as described herein and indicated on drawings.

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.

D. Telecommunications Bonding Backbone (TBB) and Grounding Equalizer (GE) provides direct bonding between different locations in a building, typically between ERs and TRs. The TBB interconnects all TGBs with the TMGB. The TBB shall be sized at minimum 3/0 AWG [14.73 mm (0.580 in)]. Whenever two or more TBBs are used within a multistory building, the TBBs are to be bonded together with a GE at the top floor and at every third floor in between. The GE is sized the same as the TBB. The sizing of the TBB Bonding is to limit potential differences between building power grounds and non active equipment grounds as is spelled out in NEC 250.58, 250.94, and 800.100(D).
THE TMGB SHALL BE INSTALLED WITH AN ADDITIONAL GROUND ROD BONDED TO THE UFER GROUND IN THE BUILDING ADHERING TO NEC.

1.3 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI/TIA-606-B-2010 Administration Standard for Commercial Telecommunications Infrastructure
   2. ANSI-J-STD-607-BA-2011 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

B. IEEE

C. Underwriters Laboratories (UL)
   1. UL 467 (1993); R 2004 Grounding and Bonding Equipment
   2. Underwriters Laboratories (UL)

1.4 SUBMITTALS

A. Conform with the requirements of Section 01330 Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:

B. Ufer Ground Rod Assembly

   1. Ground Rod:
      a. High strength high carbon steel, with electrolytically bonded jacket of copper on surface
      b. 5/8" diameter minimum
      c. 5' long minimum
      d. UL spec. 467
      e. ANSI C-33.8-1072
      f. Manufacturer:
         i. Allied Bolt
         ii. Inwesco 12A60
         iii. Blackburn
         iv. Cooper Power Systems
         v. Weaver
         vi. Erico "Cadweld" Products, Inc.
         vii. ITT Blackburn
         viii. Or approved equal.
2. **Ground Wells:**
   a. Christy Concrete Products, Inc.
   b. Forni Corp.
   c. or approved equal.

3. **Ground Bushings, Connectors, Jumpers and Bus:**
   a. O-Z/Gedney.
   b. Thomas & Betts Corp.
   c. or approved equal.

4. **Compression Connector Lug**
   a. Panduit
   b. Harger Lightning & Grounding
   c. or approved equal.

5. **Telecommunications Ground Bus Bar**
   a. Panduit
   b. Harger Lightning & Grounding
   c. or approved equal.

6. **Rack and Cabinet Grounding**
   a. Panduit Structured Ground Kit
   b. Harger Lightning & Grounding
   c. or approved equal.

7. **Bonding Ribbon:**
   a. Annealed solid copper 3/8 inch wide x 1/16 inch thick, tin plated.
   b. Manufacturer:
      i. Inwesco 12A55
      ii. Corning Cable Systems
      iii. Preformed Line Products
      iv. or approved equal.

8. **Bonding Ribbon Clamp:**
   a. Soft lead
   b. 1/16 inch thick
   c. Bolt hole for attachment
   d. Manufacturer:
      i. Inwesco 12A56
      ii. Corning Cable Systems
      iii. Preformed Line Products
      iv. Or approved equal.

9. **Fargo Clamp:**
   a. Cast copper, silver plated, furnished with copper bolt.
   b. RUS Listed
   c. Manufacturer:
      i. Allied Bolt
      ii. Inwesco 12A57
      iii. Corning Cable Systems
      iv. or approved equal.

10. **Ground Inserts:**
    a. Ground inserts provide a threaded point for attachment of ground wires or bonding ribbon. Inserts are flush mounted in manholes or vaults with their tails attached to rebar cage in the substructure
    b. Cast Bronze w 1/4 Copper Rod.
    c. Provide minimum two each maintenance hole.
    d. Provide minimum one each maintenance hole or vault.
    e. Manufacturer:
       i. Inwesco 12H69
       ii. or equal by vault or manhole manufacturer.
       iii. or approved equal.
2.2 TELECOMMUNICATIONS MAIN GROUND BAR (TMGB)

Copper ground bar,

A. 4 in. wide X .25" thick X 12 in. long. Provide mounting brackets manufactured from high-quality 300 series stainless steel. Mounting holes are 3/8" diameter spaced 5.75" apart. Preassembled and consists of: Busbar, insulators, stand-off brackets, 4 stainless steel bolts, 4 lock washers, 4 flat washers, to accommodate two-hole lug attachment using the BICSI pattern.

a. Manufacturer:
   i. CPI_Mfg. Part: 10622-010.
   ii. or approved equal.

2.3 TELECOMMUNICATIONS GROUND BAR (TGB)

A. Copper ground bar, Telecommunications Main Grounding Busbar provides a central ground attachment point for telecommunications bonding backbones, equipment and the building's ground electrode system. All Grounding Busbars are UL Listed. Hole patterns on Busbars accommodate two-hole lugs per the recommendation of BICSI and ANSI/EIA/TIA-607 standards. Insulators electrically isolate Busbars from the wall or other mounting surfaces.

a. Manufacturer:
   i. CPI_Mfg. Part: 10622-010 or approved equal.

2.4 GROUND AND BONDING CONDUCTORS

A. General purpose insulated: UL listed and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.

B. Cable jacket marking:

1. Must be legible and shall contain the following information:
   a. Manufacturer’s name
   b. Copper conductor gauge
   c. UL listing
   d. Cable jacket shall be green with black lettering

C. Telecommunications Bonding Backbone Cable: 3/0 AWG THHN/THWN CU - Must be UL listed.

a. Manufacturer:
   i. General Cable
   ii. Harger Lightning & Grounding
   iii. or approved equal.

D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provided with termination screw or lug.
E. Sizing of the telecommunications bonding conductor per ANSI J-STD-607-B

<table>
<thead>
<tr>
<th>TBB Length [Linear m (ft)]</th>
<th>TBB Size (AWG)</th>
</tr>
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<tbody>
<tr>
<td>Less than 4 (13)</td>
<td>6 [4.1 mm (0.16 in)]</td>
</tr>
<tr>
<td>4 to 6 (13 to 20)</td>
<td>4 [5.2 mm (0.20 in)]</td>
</tr>
<tr>
<td>6 to 8 (20 to 26)</td>
<td>3 [5.8 mm (0.23 in)]</td>
</tr>
<tr>
<td>8 to 10 (26 to 33)</td>
<td>2 [6.5 mm (0.26 in)]</td>
</tr>
<tr>
<td>10 to 13 (33 to 44)</td>
<td>1 [7.4 mm (0.29 in)]</td>
</tr>
<tr>
<td>13 to 16 (44 to 52)</td>
<td>1/0 [12.24 mm (0.482 in)]</td>
</tr>
<tr>
<td>16 to 20 (52 to 66)</td>
<td>2/0 [13.41 mm (0.528 in)]</td>
</tr>
<tr>
<td>Greater than 20 (66)</td>
<td>3/0 [14.73 mm (0.580 in)]</td>
</tr>
</tbody>
</table>

2.5 COMPRESSION CONNECTOR LUG

A. Description

1. Long-barrel compression lugs shall be used on all ground wire.
2. Copper alloy body.
3. Provide lug size to match conductor being terminated.
4. Provide 2 hole pattern lugs.
5. Provide each lug with silicon bronze hardware, including 2 bolts, 2 split lock washers and 2 nuts.
   a. Manufacturer:
      i. Panduit
      ii. Harger Lightning & Grounding GECLBxxx (xxx depending on Cable Size)
      iii. or approved equal.

2.6 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150 degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.7 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

A. Where required by the Drawings or 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.

1. 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.
2. 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.

2.8 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Two Hole Tinned Flat Braided Copper Ground Straps, 6 Gauge equivalent, 12” long with crimped lugs on each end and ¼”-20 mounting hardware.
   a. Manufacturer:
      i. Harger GS12094122C3/8
2.9 NETWORK EQUIPMENT BONDING BUSS BAR / ENERGIZED RACKS

A. Wall-Mount Busbar Kit; 2"W x 0.25"H x 10"L, Chatsworth 13622-010, Hole pattern accommodates two-hole lugs per the recommendation of BICSI and ANSI/EIA/TIA-607 standards. Insulators electrically isolate Busbars from the wall or other mounting surfaces, thereby controlling the current path.

B. Vertical Buss Bar Kit; 1/4"W X 5/8"H x 72"L, Chatsworth 40161-072, Hole pattern accommodates two-hole lugs per the recommendation of BICSI and ANSI/EIA/TIA-607 standards. Insulators electrically isolate Busbars from the wall or other mounting surfaces, thereby controlling the current path.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide Grounding and Bonding according to the most restrictive requirements of:
   1. ANSI-J-STD-607-B.
   2. California Electrical Code Article 250 and references therein.
   3. California Electrical Code Article 800.

B. In the event of conflicting requirements, California Electrical Code requirements shall prevail.

C. 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 Section 16450
   2. A licensed electrical contractor shall perform termination of the main bonding conductor from the TMGB to the building service entrance ground.

D. 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.
   2. The ground bar shall be installed in a horizontal orientation at a Min. 90 inch height above finished floor and at the location indicated on the Telecom drawing for each Telecom Room.
   3. All connections to the ground bar shall use Antioxidant (*NOLOX) Joint Compound.

E. GROUND AND BONDING CONDUCTOR INSTALLATION
   1. Any conduit required by the Electrical Code for the installation of Bonding Conductors outside the Telecom Room will be the responsibility of the Electrical Contractor.
   2. All lug connections to the ground bars and opposite end shall use Antioxidant Joint Compound.
   3. Contractor shall install a minimum 3/0 gauge bonding conductor using a 2-hole, long-barrel compression lug from the TMGB ground bar in the main Telecom Room to the main ground bar at the main building electrical service. NO CONNECTION SHALL BE MADE BY THE C-7 CONTRACTOR TO THE ELECTRICAL SERVICE GROUND BAR! This shall be done by a Licensed Electrician only. There shall be no mechanical splices or mechanical couplers
installed between the wire points of origin and termination.

4. Contractor shall install a minimum 3/0 gauge bonding conductor using a 2-hole, long-barrel compression lug from the TMGB ground bar in the main Telecom Room to all other TGB ground bars in each Telecom Room. There shall be no mechanical splices or mechanical couplers installed between the wire points of origin and termination.

5. Contractor shall install a minimum 3/0 gauge bonding conductor using a 2-hole, long-barrel compression lug between the TMGB to other TR’s within the structure or from the UFER building ground and all other TR’s within the structure.

6. Bonding of TR’s in other configurations, contact an IT facilities representative for approval.

7. Unless otherwise noted, all bonding and ground wires on telecom cable trays and runways shall be routed on the outer edge of the cable trays and runways.

F. Mechanical Connections

1. Make connections bare metal to bare metal.
2. Where required, remove paint to bare metal, make grounding or bonding connection, and touch up paint.
3. Torque threaded fasteners to manufacturer’s recommended values.

G. Compression Connections

1. Make compression connections with the lug or fitting manufacturer’s recommended tooling, with the tooling set to the recommended force and stroke.

H. Underground Communications Structure Ground Rods

1. A ground rod shall be installed at new communications handholes, vaults, manholes and pullboxes installed by the work of this Project, or at existing underground structures used by the work of this Project lacking a ground rod.
   a. Provide two ground rods at maintenance holes.
   b. Elsewhere provide one ground rod.
2. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.
3. Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice.
   a. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations.
   b. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

I. Communications Cable Tray, Conduit, Raceways and Sleeves

1. Bond per project documentation external to this specification.

J. Ladder Rack

1. Coordinate with the Base Building Construction Contract.
2. Provide manufacturer’s bonding clips, plates or jumpers as required to comply with the UL Classified conditions for use as an equipment grounding conductor.
3. Bond the Cable Runway to the Telecommunications Ground Busbar at the Telecommunications Room served.

K. Bond per project documentation external to this specification, Cable Shields
   1. Comply with California Electrical Code Article 800.

L. Protector Fields
   1. Comply with California Electrical Code Article 800.

M. Telecommunications cabinets and enclosures
   1. Bond to the Telecommunications Ground Busbar at the Telecommunications Room.

N. Emergency/Information Telephone enclosures
   1. Cabling supporting equipment that is subject to lightning strikes shall be protected at the building entrance with applicable surge protection and applicable bond / ground at the building entrance.
   2. Bond as detailed on Telecommunications Drawings.

O. Telecommunications Broadband Systems
   1. Comply with California Electrical Code Article 820.
   2. Ground Broadband passives as shown on Telecommunications Drawings.

3.2 LABELING

A. Provide labeling according to the requirements of:
   1. ANSI/TIA/EIA-606-A.
   2. Section 16740 - Identification for Communications Systems.

END OF SECTION 16705
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This document does not circumvent engineering or approved drawings provided by UCDMC.

B. 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

C. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1. Section 16700 – Common Work Results for Communications applies to this Section.
2. Section 16705 – Grounding and Bonding for Communications Systems
3. Section 16740 – Identification for Communications Systems
4. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
5. Section 16765 – Communications Termination Blocks and Patch Panels
6. Section 16770 – Communications Cable Management
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 DESIGN REQUIREMENTS

Engineering group to design seismic restraints and installation drawings for all telecommunications racks and UPS systems. 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.

a. Engineered drawings to be accompanied by anchorage calculations indicating that it shall remain attached to the mounting surface after experiencing forces in conformance with California Code of Regulations, Title 24, 2016 California Building Code.

b. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

B. Supports for such items, including racks, 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 Base Building Construction Project
   a. Occupancy Category: III.
   b. Site Classification: D.
   c. Seismic Design Category: D.
   d. Importance Factor: IP = 1.25
   e. Spectral Acceleration: SDS = 0.52g
   f. SD1= 0.31g.

1.4 REFERENCES

A. American Institute Of Steel Construction (AISC)

B. American Society For Testing and Materials (ASTM)
   1. ASTM A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153/A153M-04 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   4. ASTM A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. American National Standards Institute (ANSI)
   1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009
5. TIA-569-C (2012 Commercial Building Standard for Telecommunications Pathways and Spaces

D. National Fire Protection Association
1. NFPA 70, National Electrical Code

1.5 SUBMITTALS
A. Conform with the requirements of Section 01330 Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications and the following:

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. Cable hooks shall be listed and labeled by Underwriters Laboratories (UL) as required.
C. Cable hooks shall have the manufacturers name and part number stamped in the part itself for identification.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES
A. General
1. Supports to be sized to suit load and selected to match mounting conditions
B. Manufacturers
1. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
a. Concrete fasteners:
   i. Hilti
   ii. Phillips "Red-Head"
   iii. Remington
   iv. Ramset
   v. Simpson Strong-Tie
   vi. Or approved equal.
b. Concrete inserts and construction channel:
   i. Unistrut Corp.
   ii. GS Metals "Globe Strut."
   iii. Thomas & Betts "Kindorf" Corp.
   iv. Or approved equal.
c. Conduit straps:
   i. O-Z/Gedney
   ii. Erico "Caddy" Fastening Products
   iii. Thomas & Betts "Kindorf" Corp.
iv. Or approved equal.

d. Beam Clamps
   i. Cooper B-Line
   ii. SuperStrut
   iii. Unistrut
   iv. or approved equal

e. Aircraft Cable Sway Braces
   i. Mason Industries
   ii. M.W. Sausse/Vibrex
   iii. Loos & Company, Inc.
   iv. Or approved equal

C. Concrete Fasteners
   1. Provide expansion-shield type concrete anchors.
   2. Provide powder driven concrete fasteners with washers. Obtain approval by University’s Representative prior to use.

D. Concrete Inserts
   1. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

E. Aircraft cable sway braces
   1. Steel rope sized to meet load.

F. Construction Channel:
   1. Construction:
      a. 1-5/8” square galvanized channel formed from U.S.S.G No. 12 or 0.109 inch cold formed steel channel.
      b. 10 foot sections.
   2. All supporting materials by same manufacturer.

G. Beam Clamps
   1. Malleable iron electro-galvanized steel beam clamps selected to match building structural steel members.

H. Conduit Straps
   1. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
      a. Use malleable strap with spacers for exterior and wet locations.
      b. Use steel strap without spacers for interior locations.
   2. Steel channel conduit strap for support from construction channel.
   3. Steel conduit hanger for pendant support with threaded rod
   4. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

I. Threaded rods, couplings, screws and nuts:
   1. Electrolytically coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.
J. Miscellaneous Parts

1. Hot dipped galvanized after fabrication; after cutting, de-burring and hole drilling. Coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.

K. Paint/Tape for Touch-up:


2.2 CABLE HANGERS

A. Ceiling Hung J-Hooks

1. Typical/Features/Functions/Construction
   a. Specifically intended to carry the load of up to 50 communications cables without applying excess forces to cables at bottom of bundle.
   b. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.
   c. Integral hanger rod attachment hardware at top.
   d. Load rated for application.
   e. Incorporates smooth 90-degree radiused edges to prevent snagging cable jackets on installation.
   f. Designed so the mounting hardware is recessed to prevent cable damage.
   g. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
   h. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.
   i. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
   j. Finishes:
      i. 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.
      ii. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.

2. Manufacturer
   a. Cooper B-Line series BCH21, BCH32, BCH64
   b. Caddy/Erico CableCat
   c. or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. 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 EXAMINATION

A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
3.3 PREPARATION
   A. Coordinate size, shape and location of concrete pads required for equipment installation with Base Building General Contractor.
   B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.
   C. Where shown on the Drawings or Specifications, install freestanding communications equipment on concrete pads.

3.4 INSTALLATION
   A. Furnish and install supporting devices as noted throughout the Communications Systems work.
   B. Communications device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.
   C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using powder actuated tools, precast inserts, expansion anchors, preset inserts or beam clamps.
   D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.
   E. Use expansion anchors or preset inserts in solid masonry walls.
   F. Use powder actuated tools, self-drilling anchors, expansion anchor, or preset inserts on concrete surfaces.
   G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
   H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.
   I. Do not drill structural steel members unless first approved in writing by the University's Representative.
   J. 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.
   K. Install surface-mounted cabinets with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.
   L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.5 ERECTION OF METAL SUPPORTS
   A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
   B. Field Welding: Comply with AWS "Structural Welding Code."
3.6 WOOD SUPPORTS
A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.7 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS):
A. Void, Plenum or Suspended Ceiling Exposed Cable Installation. Where drawings specifically show or permit use of exposed cable installation in voids, conform to the most restrictive requirements of Code, TIA-569-C and this Section.
B. Provide support for all cabling. Do not place or attach directly to T-bar grid, concealed spline grid, flexible or rigid ductwork, HVAC registers, sprinkler piping or fixtures, light fixtures or building structure.
C. Conform to the California Electric Code.
D. Placement:
   1. All pathways created by ceiling hung cable hooks shall be reviewed by the University’s Representative prior to installation.
   2. Ceiling hung cable hooks and cabling supported by same shall not obscure access to access doors, hatches, air dampers, valves, filter sections, VAV boxes, cable trays, junction boxes, pull boxes or similar areas of access required by other trades.
   3. All ceiling hung cable hooks shall be mounted close enough together such that upon completion of the station cable installation a minimum amount of cable droop occurs between adjacent rings. The distance between supporting rings shall not exceed 48 inches or as required by the current edition of TIA-569-B.
E. Refer to the separation requirements listed in Section 16790 – Communications Horizontal Cabling for minimum distances from electrical power and other electro-magnetic sources.
F. Follow manufacturer’s recommendations for allowable fill capacity for 2 inch cable hook. In no case shall there be more than (50) Fifty UTP Cables supported by one hook.
   1. Cable hooks shall be capable of supporting a minimum of 10 pounds with a safety factor of 2.5.
   2. Spring steel cable hooks shall be capable of supporting a minimum of 10 pounds with a safety factor of 2.5 where extra strength is required.
   3. No hook shall be loaded to support more than 10 pounds to avoid deforming cables on the bottom of the hook.
   4. Where aggregate cable bundle supported by ceiling hung cable hooks exceeds either the rated cable or weight load limit of the ceiling hung cable hook system, provide ceiling basket tray.
G. Follow manufacturer’s recommendations for allowable fill capacity for (Two) 2 inch or one 4 inch cable hook. In no case shall there be more than (50) Fifty UTP Cables supported by one hook.
   1. Complete per Engineering drawing or
   2. Cable hooks shall be capable of supporting a minimum of 25 pounds with a safety factor of 2.5.
   3. Spring steel cable hooks shall be capable of supporting a minimum of 25 pounds with a safety factor of 2.5 where extra strength is required.
4. No single hook shall be loaded to support more than 25 pounds to avoid deforming cables on the bottom of the hook.

END OF SECTION 16710
SECTION 16712
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:
A. Provide telecommunications pathways in accordance with EIA TIA/EIA-569-B, as specified in this Section and as shown on the plans. Provide system furniture pathways in accordance with UL 1286. Provision of all low voltage Communications Systems Pathway and Electronic Security and Safety System Pathway, including:

1. Rigid steel conduit and fittings
2. PVC insulated rigid steel conduit and fittings
3. Intermediate metal conduit and fittings
4. Electrical metallic tubing and fittings
5. Flexible metallic conduit and fittings
6. Liquidtight flexible metallic conduit and fittings
7. Miscellaneous conduit fittings and products
8. Junction Boxes
9. Floor Boxes
10. Hinged cover enclosures
11. Pullboxes and Terminal Cabinets
12. Electrical Power Wiring Devices (Hospital Grade)

B. At Hazardous Occupancies, installation conforms to the requirements of California Electric Code for Class and Division rating of spaces.

1.2 RELATED WORK IN OTHER SECTIONS:
A. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1. Section 16700 – Common Work Results for Communications
2. Section 16705 – Grounding and Bonding for Communications Systems
3. Section 16710 – Hangers and Supports for Communications Systems
4. Section 16790 – Communications Horizontal Cabling

1.3 REFERENCES
A. Usage: In accordance with Section 01410 – Regulatory Requirements.

1. American National Standards Institute (ANSI)
   a. ANSI C80.1 1994 Rigid Steel Conduit - Zinc Coated
   b. ANSI C80.3 1991 Electrical Metallic Tubing - Zinc Coated

2. National Electrical Manufacturers Association (NEMA)
   a. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
b. NEMA FB 1 (ANSI/NEMA FB 1-2003) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

c. FB 2.10 2000 Selection and Installation Guidelines For Fittings For Use With Non-Flexible Metallic Conduit Or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, And Electrical Metallic Tubing).

d. FB 2.20 2000 Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

e. NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems

f. NEMA OS 3-2002 Selection and Installation Guidelines for Electrical Outlet Boxes.

g. NEMA RN 1-1998 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

h. NEMA TC 7 2000 Smooth Wall Coilable Polyethylene Electrical Plastic Duct

i. NEMA TC 13 2000 Electrical Nonmetallic Tubing (ENT).

j. NEMA TC 14 1984(R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings

3. Underwriters Laboratories, Inc. (UL)

a. UL 1 2000 Flexible Metal Conduit

b. UL 6 2004 Electrical Rigid Metal Conduit - Steel


d. UL 360 1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit

e. UL 514A 1991 (R 2004) Metallic Outlet Boxes

f. UL 514B 1989 (R 2004) Conduit, Tubing and Cable Fittings


i. UL 797 1993 (R 2004) Electrical Metallic Tubing - Steel


l. UL 1479 Fire Tests of Through Penetration Firestops

m. UL Fire Resistance Directories

1.4 SUBMITTALS

A. Conform with the requirements of Section 01330 – Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this Section may be used on the project unless otherwise submitted and approved by the University’s Representative.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the following types of conduit systems listed by their commonly used generic name.
2.2 RACEWAY

A. Manufacturers:
   1. Raceway:
      a. Allied Tube and Conduit Co.
      b. Triangle PWC, Inc.
      c. Western Tube and Conduit Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Aflfix Corp.
      g. American Flexible Metal Conduit Co.
      h. Anaconda.
      i. Or equal.
   
   2. Fittings:
      a. Appleton Electric Co.
      b. OZ/Gedney
      c. Thomas & Betts Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Carlon
      g. Or equal.

B. Rigid Steel Conduit.
   1. Drawing and Spec Reference: RSC.
   2. Construction:
      b. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
      c. Three piece couplings: Electroplated, cast malleable iron.
      d. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.
      e. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
      f. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
      g. All fittings and connectors shall be threaded.

C. Coated Rigid Steel Conduit:
   1. Drawing and Spec Reference: CRSC.
   2. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
   3. Fittings:
      a. Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.
      b. Fittings over-sleeve to extend 1 conduit diameter or 1-1/2" beyond fitting, whichever is less.
   4. Performance:
      a. Tensile Strength: 3500 psi.
   5. Approvals:
      a. NEMA RN1 (Type 40 - 40 mils thick)
      b. CalTrans Type 2
6. Manufacturers:
   a. Plastibond by RobRoy Industries
   b. Occal-40 by Occidental Coating Company
   c. KorKap by Plastic Applicators
   d. Ocal-Blue
   e. Or equal.

D. Intermediate Metal Conduit
   1. Drawing Reference: IMC
   2. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
   3. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

E. Electrical Metallic Tubing.
   1. Drawing and Spec Reference: EMT.
   2. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 specifications and shall meet UL classifications.
   3. Raintight compression couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
   4. Raintight compression connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.
   5. Use of set-screw couplings and connectors is not permitted.

F. Flexible Conduit:
   1. Drawing Reference: FLEX
   2. Construction:
      a. Flexible steel, zinc coated on both inside and outside by hot-dipping process.
      b. Interlocking spirally wound continuous steel strip.
      c. 1 ¼” minimum size.
   3. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.
   4. Approvals:
      a. UL 1

G. Liquidtight Flexible Metallic Conduit
   1. Drawing Reference: Liquidtight
   2. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
   3. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.3 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. General
   1. UL 514B
2. Listed in UL Electrical Construction Materials List

B. Conduit Fittings, Insulated Throat Grounding Bushings
   1. Description
      a. Threaded for Rigid Steel Conduit and Intermediate Metal Conduit
      b. UL Listed for use with copper conductors
      c. Thermoplastic insulated liner for 105 degrees Celsius
      d. Body of malleable iron, zinc plated; or die cast zinc
   2. Manufacturer
      a. Thomas & Betts (Steel City) BG-801 Series
      b. O-Z/Gedney
      c. Or equal.

C. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

D. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

E. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

F. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514.
   1. Manufacturer:
      a. OZ/Gedney Type DX
      b. Steel City Type EDF
      c. Or equal.

G. Fire rated penetration seals:
   1. UL classified.
   2. Conduit penetrations in fire rated separation shall be sealed with a UL classified assembly consisting of fill, void or cavity materials.
   3. The fire rated sealant material shall be the product best suited for each type of penetration, and may be a caulk, putty, composite sheet or wrap/strip.
   4. Penetrations of rated floors shall be sealed with an assembly having both F and T ratings at least equal to rating of the floor.
   5. Penetrations of rated walls shall be sealed with an assembly having an F rating at least equal to the rating of the wall.

H. Standard products not herein specified:
   1. Submit for review a listing of standard electrical conduit hardware and fittings not herein specified prior to use or installation, i.e. locknuts, bushings, etc.
   2. Listing shall include manufacturers name, part numbers, and a written description of the item indicating type of material and construction.
   3. Miscellaneous components shall be equal in quality, material, and construction to similar items herein specified.

I. Hazardous area fittings: UL listed for the application.
2.4 JUNCTION AND DEVICE BOXES

A. Junction and Device Boxes

1. Drawing References: As shown on Symbol Schedule

2. Construction:

   a. Concealed/Flush Mounted:
   b. One or two piece welded knockout boxes.
   c. UL 514A, cadmium or zinc-coated 1.25 oz/sq. ft., if ferrous metal
   d. Pressed sheet steel, for indoor locations
   e. UL 514C approved if non-metallic
   f. At hollow masonry, tile walls and plaster walls, provide with device rings as required.
   g. Surface mounted:
      i. Exterior - Conform to the Junction and/or PullBox construction scheduled on the Plans. Where construction not otherwise scheduled or noted on the plans, conform to the following: (1) Cast iron or aluminum with threaded hubs and mounting lugs. (2) Gasketed cover with spring lid
      ii. Concrete floor embedded: (1) Cast iron concrete pour boxes with screwed brass cover, unless otherwise noted. (2) Cadmium plated screw cover attachment at least 6" on center.
   h. If size not otherwise noted, at least 4S (4" square) by 2-1/8" deep, or Code minimum size, whichever is larger.
   i. Wherever 4S is indicated, contractor may at their option substitute 4-11/16" square boxes while maintaining the minimum depth required by these specifications and the drawings.
   ii. At recessed masonry wall installations, provide gangable masonry boxes.
   iii. Provide complete with approved type of connectors and required accessories, including attachment lugs or hangers. Provide raised device covers as required to accept scheduled device.

3. Approvals.

   a. UL 514A

4. Manufacturers:

   a. Interior:
      i. Steel City.
      ii. Bowers
      iii. Randl Industries, Inc. (5S Boxes)
      iv. or equal.
   b. Interior, 5S Boxes
      i. Randl, Inc. 5 Square Telecommunications Boxes
      ii. Or equal.
   c. Exterior, exposed with cover of same construction.
      i. Appleton
      ii. Pyle-National
      iii. Or equal.
   d. Other conditions:
      i. Any meeting approvals and requirements.

B. Flat-panel Wall Box

1. Drawing reference: FPWB
2. Features, functions and construction:
   a. Box provides means to install audiovisual, network and power receptacles flush in wall behind flat-panel display. With box cover installed, connectors are concealed and cables, both power and communications pass through slot at base of cover plate into connection points on back of flat-panel.
   b. Cover plate protrudes less than 1/2" from face of wall.
   c. 16 gauge box construction with 1/16" inch thick minimum cover plate, white finish baked enamel or powder coat, field paintable
   d. Box incorporates provisions to mount up to two electrical device boxes for provision of duplex power receptacles either from above or below.
   e. Additionally box mounts manufacturers low-voltage conduit entry box which accommodates manufacturer's line of audiovisual connector inserts. Design of FP WB permits installation of up to two low-voltage conduit entry boxes, which may be mounted either above or below the FPWB.
   f. Manufacturers audiovisual insert line shall support at least the following receptacles:
      i. BNC, in combinations of 1 to 5 BNC's, color-coded for composite, component analog and RGBHV video formats, as required.
      ii. RCA, in combinations of 1 to 3 RCA's color-coded for composite and component analog video formats, as required.
      iii. S-Video
      iv. XLR, 3 and 4 pin
      v. DB-15
      vi. DB-9
      vii. Neutrik Speakon
      viii. DVI
      ix. HDMI
      x. 1/4" and mini TRS
   g. Fill unused openings with blank inserts.

3. Manufacturers:
   a. FSR Inc. PWB-100, with connectors and inserts from manufacturer's IPS series as required to provide the interfaces and connectivity indicated on the plans.
   b. Or equal (no known equal).

2.5 VIDEOCONFERENCE CAMERA ENCLOSURES

A. Camera Enclosures, In Wall
   1. Minimum features Functions & Construction:
      a. Provide camera mounting to conform with California Access Compliance requirements.
      b. Coordinate mounting location with /av system provider, to provide a clear view at the height indicated on the drawings of the occupants in the room.
   2. Manufacturers
      a. Cisco
      b. Or equal.

2.6 CABINETS AND ENCLOSURES

A. Terminal Cabinets:
   1. Drawing Reference: As Scheduled.
   2. Construction:
      a. Zinc Coated Sheet Steel, code gauge with standard concentric knockouts for conduit terminations.
b. Interior dimensions not less than those scheduled.
c. Finish: Manufacturer's standard gray baked enamel finish.
d. Covers: Trim fitted, continuous hinged steel door, flush catch – lockable and keyed to match. Screw fastened doors not acceptable.
i. Door face to be not less than 95% of panel interior dimensions.

3. Mounting:
   a. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
   b. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.
   c. Interior Applications:
      i. NEMA 250 Type 1, unless otherwise noted. Refer to plans and schedules.
   d. Exterior Applications:
      i. NEMA 250 Type - As Scheduled, not less than NEMA 3R.

4. Manufacturers:
   a. B-Line Electrical Enclosures
   b. Circle AW Products.
   c. Hammond
   d. Henessey
   e. Hoffman.
   f. Myers Electric Products
   g. Rittal
   h. Or equal.

2.7 FLOOR BOXES, POKE-THROUGHS AND MONUMENTS

A. Floor Box, Flush Devices
   1. Construction
      a. Two adjacent 1 gang compartments with class divider
      b. Installed devices face upward, protected from debris by hinged flip lids designed to withstand pedestrian traffic and hand trucks without cracking.
      c. Typical, provide lid fitted with 2-1/4” openings for liquidtite to feed permanently installed furniture.
      d. Floor box construction:
         i. Above grade, stamped metal or cast iron
         ii. At grade: Cast iron, suitable for installation at grade
         iii. Box height fully adjustable during installation
         iv. Plastic or brass lid construction to be selected by University's Representative

2. Manufacturers
   a. Wiremold
      i. Above grade: 880S2
      ii. At grade: 880CS2-1
      iii. Plate, Brass Option (Confirm approved finish with University's Representative): 827 Series Flange, 828 Power Cover, 828GFI Communication Cover, AC-MAB-020 Activate Bezel. Where box to be outfitted with sealtite pathway, provide communications portion with 829CK plate.
   b. Thomas & Betts
   c. Hubbell
   d. Lew Electric
   e. Or equal.

B. Floor Box, Cast Iron, Recessed Devices, with Lid Designed to meet UL Scrub Water Listing
1. Construction
   a. At grade conditions, Cast Iron, suitable for grade installation without
      special means of protection. Elsewhere, cast iron or stamped steel.
   b. Four 1-Gang openings divisible between power and low voltage
      applications fully recessed below the floor level.
   c. Slotted and gasketed activation cover provides protection for both
      communications and electrical receptacles at box interior. Activation
      cover has removable recesses to permit installation of pieces of
      surrounding flooring finish to be integrated in lid to minimize visual
      appearance of lid. Activation covers shall be manufactured of die-cast
      aluminum or die-cast zinc, and be available in a plated brass finish.
      Activation covers shall be available in flanged and flangeless versions -
      select to match surrounding floor covering. Covers shall be available with
      options for tile or carpet inserts, flush covers, or covers with one 1" trade
      size screw plug opening and one combination 1 1/4" and 2" trade size
      screw plug openings for furniture feed applications. Covers, when open,
      provides at least 35 square inches of clear opening to access
      receptacles at box interior.
   d. Cables can be routed internally between two adjacent 1 gang openings
      to permit a single conduit to serve both.
   e. UL Listed for power service.
   f. Lid rated for 900 pound load without damage.

2. Approvals:
   a. UL 514C scrub water

3. Manufacturers
   a. Wiremold RFB4-4DB above grade and RFB4-C1-1 at grade conditions.
      Provide FloorPort Flanged Cover Assemblies to match floor conditions,
      University's Representatives finish selection, and exit raceway, where
      indicated. Provide internal device brackets to match specified
      communications devices and plates. Coordinate electrical rough-in with
      requirements of Division 26. Provide rough-in as required to mount
      specified communications fill.
   b. Thomas & Betts
   c. Hubbell
   d. Or equal

C. Floor Box High Capacity, 3 Compartment
1. Plan Reference: FC4, FW4, FR4
2. Features
   a. UL Listed
   b. Box
      i. Size at least 10 inches by 12 inches by 6 inches deep.
      ii. Three compartments, with voltage barriers, with standard
          electrical plate mounting brackets for at least:
          (1) One single gang
          (2) One 2 gang
          (3) One 4 gang
   c. Knockouts concentric, combination 1 inch and 1.25 inch.
   d. Cover for carpet finish
   e. Cover size approximately 10.5 inches by 12.5 inches.
   f. At least 11 gauge steel.
   g. Brass carpet flange edging.
      i. Option of 0.25 inch or 0.5 inch flange height to be selected by
         the University's Representative to match selected carpet
h. Within cover, provide a lift-off, full-access door, open area approximately 6.5 inches by 8 inches.

i. Within the lift-off, full-access door, provide a hinged, fold-back cable exit port.

j. Open area approximately 2 inches by 2 inches.

k. Flush in closed position.

3. Applications:
   a. FC4: Concrete floor systems. Provide “pour pan” protection at slab on grade conditions
   b. FR4: Raised Floor Conditions.
   c. FW4: Wooden Floor Conditions.

4. Approvals:
   a. UL 514A scrub water

5. Manufacturers
   a. FSR Inc.
      i. FC4: FL-500P-(cover flange code)-4. Supply larger boxes where scheduled and indicated plates and jacks require it. Provide manufacturer's “Pour Pan” FL-GRD2 or FL-GRD4 to protect from moisture at installations at grade level.
      ii. FW4, FR4: FL-540P-(cover flange code)-4. Supply larger boxes where scheduled and indicated plates and jacks require it.
   b. RCI Systems, Inc.
      i. FC4: FB-2600. Supply larger boxes where scheduled and indicated plates and jacks require it. Provide manufacturer's "Pour Pan" to protect from moisture at installations at grade level.
   c. Wiremold/Walker RFB-11.
   d. Or equal.

D. Floor Box High Capacity, 4 Compartment

1. Plan Reference: FC5

2. Features
   a. UL Listed
   b. Box
      i. Size at least 12 inches by 14 inches by 6 inches deep.
      ii. Four compartments, with class of service barriers, with trade standard electrical plate mounting brackets for at least:
         (1) Two single gang
         (2) One 3 gang
         (3) One 6 gang
   c. Knockouts concentric, combination 3/4 inch and 1 inch and combination 1.25 inch and 2 inch.
   d. Boxes shall consist of a concrete-tight stamped steel construction with 14 gauge sides and bottom and a 10 gauge steel top. At slab on grade conditions, provide painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete.
   e. Box to be approved for use in on grade and above-grade concrete floor slabs.
   f. Cover
      i. Cover shall be cast aluminum. Lid to be offered with solid, flush surface for tile, wood or terrazzo and an insert option for carpet inlay.
      ii. Egress to be provided by two 15/16” x 6-3/8” access doors. Access door is to fold under lid during cable exit for unobtrusive appearance and mechanical protection.
g. Load Capacity:
   i. Activation covers must meet or exceed the 3,000 pounds.

h. Flush in closed position.

3. Approvals:
   a. UL 514A scrub water

4. Manufacturers
   a. Wiremold/Walker RFB-11
   b. FSR
   c. Or equal.

E. Floor Box, Electrified Furniture Feed
1. Plan Reference: FC6
2. Minimum Box Features/Function/Construction:
   a. Stamped steel or cast construction
      i. If stamped steel, provide painted with a fusion-bonded epoxy
designed for use on metal reinforcement bar and related
accessories before encapsulation in concrete,
   b. Approved for use on grade and above grade floors.
   c. The box shall have nominal dimensions of 13 1/8" L x 12 1/2" W x 3 1/4" H
   d. Six independent wiring compartments that allow capacity for up to six
duplex receptacles and/or communication services.
   e. Construction permits feed through tunneling from adjacent
compartments.
   f. Two of the six compartments shall have a minimum wiring capacity of 23
cu in.
   g. Four compartments shall have a minimum wiring capacity of 52 cu in.
   h. The box have at least the following number of trade standard conduit
knockouts:
      i. Twelve ¾"
      ii. Four 1"
      iii. Twelve 1-1/4"
   i. The box shall be fully adjustable, providing at least 1-3/8” of pre-pour
adjustment, and at least 3/4” of after-pour adjustment.
   j. The box shall provide a series of device mounting plates that will accept
both duplex power devices, as well as plates that will accommodate
University standard workstation connectivity outlets and modular inserts,
and other open system devices.

3. Minimum Cover/Lid Features/Function/Construction:
   a. Flanged cover for use in tile or carpet installation.
   b. Die-cast aluminum assembly available in black, bronze, brass, nickel,
gray, or brushed aluminum for color selection by the University's
Representative.
   c. Provided with one 1” trade size screw plug for power or communication
type cabling and one combination 1-1/4” and 2” trade size screw plug for
communication type cabling.
   d. Allows for feeding both power and communication cabling.

4. Approvals:
   a. UL
   b. The activation cover shall have been evaluated by UL to meet the
applicable U.S. safety standards for scrub water exclusion when used on
tile, terrazzo, wood, and carpet covered floors.

5. Manufacturers:
   a. Wiremold RFB6-OG with FloorPort Series Cover FPFFTC**, where **
reflects the color option selected by the University.
   b. Hubbell
   c. FSR
d. Or equal.

F. Electrified Furniture Monuments
1. Plan Reference: EFM
2. Construction:
   a. Above slab box construction
      i. At least 9" wide x 4" deep x 2-1/2" tall
      ii. .125 clear anodized aluminum
      iii. Four piece assembly with removable three sided upper shell, two
device plates, and fixed three piece lower shell.
   b. Floor Box
      i. Coordinate box selection with required conduit/pathway count,
diameter and required cable fill.
      ii. Concrete tight
         (1) Single gang box, 48 cubic inch minimum capacity.
         (2) Deep floor box provides at least 3-1/4" internal depth.
         (3) Chase nippled to above slab box through 2" minimum
diameter opening
      iii. Floor box construction:
         (1) At grade, cast iron
         (2) Elsewhere, stamped metal or cast iron
      iv. Box height fully adjustable during installation
   c. Manufacturers:
      i. Walker RCI FIT Series 241 Head with FP1.562-1.562 Plate on
connected side, FPB-B blank plate on the other. Floor box:
800CILCK at grade, 800LCK elsewhere, with 825CK conversion
kit.
      ii. Hubbell
      iii. Thomas & Betts.
         (1) Floor Box: 600 Series at Grade, 68 Series elsewhere,
P60-2 lid
         (2) Above ground head to match specification requirements.
         (3) Or equal.

G. Floor Poke Through Assembly, Communications and Electrical Receptacle Face Fitting.
1. Drawing Reference: FP1
2. Features, Function, Construction
   a. Mounts flush in floor.
   b. Black plastic circular face is scuff resistant, extension above finished
floor conforms with ADA maximum rise requirements.
   c. Brass finish perimeter trim.
   d. Terminates at least 4 campus standard communication jacks below floor
line.
   e. Self sealing assembly provides through penetration sealant at point of
insertion suitable for use in a 2 hour floor assembly.
   f. Provides for 4 hospital grade electrical receptacles in surface of plate.
   g. Sliding cover mounted in face provides access to jacks below. Individual
slide covers and "Dead-front" protection. Slide covers protect power and
communication devices. Power slide covers snap back in place when
power receptacles are not in use to prevent water, dirt, and debris from
entering device. Flexibility to activate either power or communication
services simultaneously or individually.
   h. Poke through electrical and communications wiring can be completed
and serviced entirely from above without the need to access the ceiling
void on the floor above.
   i. Separate pathways for communications and power wiring
   j. Conduit stub below mounts trade standard fittings.
3. Approvals  
   a. UL Listed and UL Fire Classified to U.S. safety standards for tile, terrazzo, under UL514A and UL514C for the scrub water exclusion test for carpet and wood floors.  
   b. Suitable for use in air handling spaces in accordance with Sec 300-22 (C) of the National Electrical Code.  

4. Manufacturers  
   a. Wiremold RC4ARTTCBS Flush Poke-Thru with accessories as required.  
   b. Hubbell  
   c. Thomas and Betts  
   d. Or equal.  

H. Floor Poke Through Assembly, 2" Diameter feed-through fitting.  
   1. Drawing Reference: FP2  
   2. Features, Function, Construction  
      a. Mounts flush in floor.  
      b. Black plastic circular face is scuff resistant, extension above finished floor conforms with ADA maximum rise requirements.  
      c. Black finish perimeter trim.  
      d. Self sealing assembly provides through penetration sealant at point of insertion suitable for use in a 2 hour floor assembly.  
      e. Single feedthrough opening accommodates either a 1-1/4" and 2" diameter trade size fitting, through a combination adapter.  
      f. Conduit stub below mounts trade standard fittings.  
   3. Approvals  
      a. UL Listed and UL Fire Classified to U.S. safety standards for tile, terrazzo, under UL514A and UL514C for the scrub water exclusion test for carpet and wood floors.  
      b. Suitable for use in air handling spaces in accordance with Sec 300-22 (C) of the National Electrical Code.  

4. Manufacturers  
   a. Wiremold RC9AM2TCBK Flush Poke-Thru with accessories as required.  
   b. Hubbell  
   c. Thomas and Betts  
   d. Or equal.  

I. Floor Poke Through Assembly, dual service feed-through fitting.  
   1. Drawing Reference: FP3  
   2. Features, Function, Construction  
      a. Mounts flush in floor.  
      b. Black plastic circular face is scuff resistant, extension above finished floor conforms with ADA maximum rise requirements.  
      c. Brass finish perimeter trim.  
      d. Self sealing assembly provides through penetration sealant at point of insertion suitable for use in a 2 hour floor assembly.  
      e. Two feedthrough openings  
         i. One 3/4" trade standard  
         ii. One 1-1/4" trade standard  
      f. Conduit stub below mounts trade standard fittings.  
   3. Approvals  
      a. UL Listed and UL Fire Classified to U.S. safety standards for tile, terrazzo, under UL514A and UL514C for the scrub water exclusion test for carpet and wood floors.  
      b. Suitable for use in air handling spaces in accordance with Sec 300-22 (C) of the National Electrical Code.
4. Manufacturers
   a. Wiremold 4FFATCBS Flush Furniture Feed Poke -Thru with accessories as required.
   b. Hubbell
   c. Thomas and Betts
   d. Or equal.

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:
   1. Exterior, Exposed:
      a. Type RSC for applications up to 8 feet AFF or to first pull box, whichever is first, applications subject to physical abuse or for applications greater than 4" diameter.
      b. EMT acceptable in all other applications not noted above up to 4", where used in conjunction with specified Raintight (compression) couplers.
   2. Interior, Exposed, Wet and Damp Locations:
      a. Type RSC.
      b. At interior locations over 8 feet above finished floor, EMT acceptable.
   3. Interior, Hazardous Locations
      a. Type RSC
      b. Type IMC, where permitted by the CEC.
   4. Interior, exposed or concealed, dry locations:
      a. RSC, if subject to physical abuse.
      b. EMT, if not subject to physical abuse.
   5. Interior, concealed, damp locations, including in masonry walls.
      a. RSC
   6. Embedded in Concrete
      a. RSC or rigid non-metallic conduit.
      b. PVC Type Schedule 40.
   7. Transition from walls, floor boxes and monuments to open plan furniture systems:
      a. Liquidtight

3.2 GENERAL REQUIREMENTS

A. Refer to the manufacturer's instructions and conform thereto.

B. Distribution Pathway via EMT Raceway:
   1. EMT conduit is to be installed meeting the NEC handbook Article 348 Installation Specifications.
   2. Provide escutcheon plates for all through wall conduit stubs.
   3. All ends of conduits shall be cut square, reamed and fitted with insulated bushing.
   4. All conduit which passes through fire walls shall be sealed with fire stop putty after all station wire has been installed.

3.3 MOUNTING AND INSTALLATION – DEVICE BOXES

A. Conform to the more restrictive of NEMA OS 3-2002 and the following.

B. Provide backboxes at all communications systems devices. Installation of device plates directly to wall surface without use of a backbox, unless specifically directed on plans, is unacceptable.
C. The distance between pull boxes shall not exceed 150 feet or more than two 90 degree bends.

D. Align boxes plumb with floor and surrounding construction. At door frames, locate 4" from frame. Verify placement with University's Representative details to ensure that box clears all trim, etc.

E. Support and fasten boxes securely. At stud walls use rigid bar hangers, attached to hanger with stud and nut.

F. At existing locations, provide cutting, patching and finishing as required to maintain or restore finishes so that resulting installation is integrated into the Architectural decor of the particular location.

G. Mounting Height: the mounting height of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate.

H. Mount outlet boxes with the long axis vertical. Three or more gang boxes shall be mounted with the long axis horizontal.

I. Install wiring jacks and outlet devices only in boxes which are clean; free from excess building materials, dirt, and debris.

J. Install wiring jacks and outlet devices after wiring work is complete.

3.4 TERMINAL CABINETS, JUNCTION BOXES AND PULL BOXES

A. General
   1. Thoroughly examine site conditions for acceptance of cabinets and enclosures installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

C. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with standards referenced in Section 16700 – Hangers and Supports for Communications Systems.

D. "Train" interior wiring, bundle and clamp using specified plastic wire wraps. Separate power and signal wiring.

E. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

F. Terminate conduit in cabinet with lock nut and grounding bushing.

G. Cleaning
   1. Touch-up paint any marks, blemishes or other finish damage suffered during installation.
   2. Vacuum clean cabinet on completion of installation.

3.5 SUPPORT

A. Provide supports for raceways as specified in Section 16710 – Hangers and Supports for Communications Systems.
B. All raceways installed in exposed dry locations shall be grouped in a like arrangement and supported by means of conduit straps, wall brackets or trapeze hangers in accordance with Code and the requirements of this Section and Section 16710 – Hangers and Supports for Communications Systems. Fasten all hangers from the building structural system.

C. Provide supports and mounting attachments per the most restrictive of Code and the following.

<table>
<thead>
<tr>
<th>Raceway Size (inches)</th>
<th>No of cables in run</th>
<th>Location</th>
<th>Support Spacing (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>RSC</td>
</tr>
<tr>
<td><strong>Horizontal Runs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1≥</td>
<td>1-2</td>
<td>Flat ceiling or wall</td>
<td>6</td>
</tr>
<tr>
<td>1≥</td>
<td>1-2</td>
<td>Where access limited to building structure</td>
<td>10</td>
</tr>
<tr>
<td>1≥</td>
<td>3≥</td>
<td>Any locations</td>
<td>10</td>
</tr>
<tr>
<td>Any</td>
<td>Any</td>
<td>Concealed</td>
<td>10</td>
</tr>
<tr>
<td><strong>Vertical Runs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 1-1/4</td>
<td>Any</td>
<td>Exposed</td>
<td>8</td>
</tr>
<tr>
<td>1-1/2≥</td>
<td>Any</td>
<td>Exposed</td>
<td>10</td>
</tr>
</tbody>
</table>

D. Install no more than one coupling or device between supports.

E. Conduit support
1. As specified in Section 16710 – Hangers and Supports for Communications Systems

F. 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.

3.6 PENETRATIONS

A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.

B. 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.

C. All communications systems conduit openings in walls and floors are the responsibility of the Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set maybe core drilled.

3.7 RACEWAY INSTALLATION

A. General
1. Raceway runs are shown schematically. Install concealed unless specifically
shown otherwise. Supports, pull boxes, junction boxes and similar generally not indicated. Provide where designated.

a. Install exposed conduit and raceway parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours. Level and square conduit and raceway runs.

b. Raceway runs shall be mechanically and electrically continuous between all each equipment rack and utility demarcation point, receptacle and/or surface raceway strip, as applies.

c. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box, or outlet by means of a locknut on the outside and a bushing on the inside or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter.

d. Bends

i. All bends or elbows shall have a minimum radius as follows:

<table>
<thead>
<tr>
<th>Conduit Size</th>
<th>Min. Radius (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>12</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>18</td>
</tr>
<tr>
<td>2&quot;</td>
<td>24</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>24</td>
</tr>
<tr>
<td>3&quot;</td>
<td>30</td>
</tr>
<tr>
<td>3-1/2&quot;</td>
<td>30</td>
</tr>
<tr>
<td>4&quot;</td>
<td>30</td>
</tr>
<tr>
<td>5&quot;</td>
<td>36</td>
</tr>
<tr>
<td>6&quot;</td>
<td>42</td>
</tr>
</tbody>
</table>

(1) Use factory elbows or machine bends for conduit bends 1-1/4" and larger.

e. Make bends and offsets so the inside diameter is not effectively reduced. Make bends in parallel or banked runs from the same center line so that the bends are parallel.

f. Install at least one jet line in all conduits of 1 to 2 "

g. Install at least one (1) 3/8", 200 pound strength nylon pull cord in all conduits of 2 " or greater in diameter. Raceways crossing building expansion joints or in straight runs exceeding 100 feet shall be provided with UL listed expansion fittings.

h. Install conduit seals and drains to prevent accumulated moisture in conduits from entering Communications System enclosures.

2. Embedded conduits in concrete slab walls, and columns shall be installed in center third between upper and lower layers of reinforcing steel as directed by the University's Representative. Space conduits 8" on center except at cabinet locations where slab thickness shall be increased as directed by the University's Representative.

3. All conduits to be kept 12" away from steam or hot water lines. Install horizontal conduit and raceway runs below water and steam piping.

4. Conduit dropping down to equipment shall be as straight as possible.

5. Conduit installed on any equipment shall be run symmetrical with the equipment and in such a manner as to:

a. not to be exposed to damage;

b. not interfere with access to components of the equipment that will interfere with maintenance operation or;

c. not to be in a manner that the University deems detrimental to its operation.
6. Whenever an installation such as that listed occurs, the Contractor shall make all necessary changes at no additional cost to the University.

7. All cut ends of conduit, shall be deburred. Exposed conduit and metallic surface raceway installed in finished spaces shall be painted to match surrounding surfaces using paint and methods directed by the University's Representative.

8. All raceways stubbing up into equipment or racks shall be sealed. Raceways with conductors shall be plugged with duct-seal. Spare raceways shall be capped. Prevent foreign matter from entering conduit and raceway; use temporary closure protection. Replace conduits containing concrete, varnish or other foreign material.

9. Use specified conduit and raceway fittings that are of types compatible with the associated conduit and raceway and suitable for the use and location. Join and terminate conduit and raceway with fittings designed and approved for the purpose of the conduit and raceway system and make up tight.

10. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed.

11. Horizontal conduit or EMT runs, where required and permitted, shall be installed as close to ceiling or ceiling beams as practical except where cable distance limitation requires consideration refer to section 16790

12. Conduit and EMT connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes or radiator branches.

13. Conduit and EMT shall not be run through beams, purlins or columns except where permission is granted by University's Representative in writing.

14. Bond installed metallic raceway in accordance with the requirements of the CEC.

3.8 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL listed sealing fittings that prevent passage of explosive vapors in accordance with the manufacturers written instructions. Locate fittings at suitable, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

C. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous locations.

3.9 REUSE OF EXISTING CONDUIT

A. General

1. Existing conduit is to be used as a pathway only where so shown on the drawings.

2. Prior to beginning work involving the use of an existing conduit, the Contractor shall consult with the University's Representative in order to establish whether or not the conduit contains active service.

3. If no active service exists within the conduit, all cable is to be removed, and work is to proceed.

4. If active service does exist within the conduit and it has been determined that service needs to be disrupted, then work on that conduit shall not proceed until a schedule of service outage has been established by University's Representative. Once given direction to proceed, the Contractor shall within the time period mutually agreed upon; remove the old cable, install, terminate and test the new cables, and notify the University's Representative the work using the specific conduit has been completed. The University's Representative shall be responsible for the disconnection and reconnecting of the active service cross-connects within the terminal closet(s).
3.10 STATION CABLE PATHWAY INSTALLATION

A. Work Area Outlet Boxes:
   1. Unless otherwise noted on the plans, all cut in boxes and surface station outlet boxes are to be installed at a height of 18" A.F.F. (above finished floor) to center, except for those intended to be used for telephone wall jacks.
   2. Those plates or boxes that are to be used for telephone wall jacks shall be installed according to ADA requirements dependent on the existing conditions of the location being cables. Refer to applicable technical documentation or University Representative.
   3. All station outlets shall be installed so that their edges are parallel to the vertical and horizontal edges of the surface on which they are mounted.

END OF SECTION 16712
SECTION 16740
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling on, or adjacent to, all cabling, connectors, innerduct, faceplates, jacks, receptacles, controls, fuses, circuit breakers, patching jacks, and racks.

B. This section includes minimum labeling requirements for the following:
   1. Communications Cabling
   2. Closet Hardware including patch panels, terminal blocks, protectors and racks
   3. Work Area Outlets
   4. Wireless Access Points
   5. Underground Vaults
   6. Pathways, Spaces, Grounding and Bonding.

C. Refer to detailed plans for additional requirements.
   1. Additional Icons as defined by University Representative
   2. Additional Patch cord bands as defined by University Representative

D. Clearly and distinctly indicate the function of the item.

E. Coordinate with Record Drawings

F. Provisions of this Section apply to Communications Work, including the following Sections:
   1. Section 16700 – Common Work Results for Communications
   2. Section 16705 – Grounding and Bonding for Communications Systems
   3. Section 16710 – Hangers and Supports for Communications Systems
   4. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
   5. Section 16765 – Communications Termination Blocks and Patch Panels
   6. Section 16770 – Communications Cable Management
   7. Section 16790 – Communications Horizontal Cabling

1.2 REFERENCES:

A. Usage: In accordance with Section 01410 – Regulatory Requirements.

B. American Society for Testing and Materials (ASTM)

C. Electronic Industries Alliance (EIA)

D. Underwriters Laboratories (UL)
   1. UL 969 (1995; R 2001) Marking and Labeling Systems

1.3 QUALITY ASSURANCE

A. Identification and administration work specified herein shall comply with the applicable requirements of:
   2. ANSI/TIA/EIA – 569B Pathway and Spaces
3. ANSI/TIA/EIA – 568C Telecommunications Cabling Standard
4. BICSI Telecommunications Distribution Methods Manual
5. UL 969 (1995; R 2001) Marking and Labeling Systems

B. UCDHS Practices
   1. All new labeling is to reflect UCDHS labeling standards. Contact the University's Representative for a copy of the current standards prior to proceeding.
   2. Bring to the University Representative's attention any project conditions not described in these specifications and the University's current standards, and conform with the direction received.

1.4 SUBMITTALS
   A. Conform with the requirements of Section 01330 - Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Procedures: In accordance with Section 01610 – Product Requirements.

1.6 SEQUENCING
   A. Not Used.

PART 2 - PRODUCTS

2.1 COMMUNICATION CABLING LABELS, INTERIOR ( FOR TYPE {A,V,C,M} CABLES )
   A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
   B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
   C. Provide vinyl substrate with a white printing area and black print. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
   D. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.
   E. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.
   F. Manufacturers:
      1. Cable Type – 4 pair UTP / 4 pair UTP Zero Skew
         a. Panduit S100X125VAC
         b. or approved equal.
      2. Cable Type – 4 pair STP
         a. Panduit S100X125VAC
         b. or approved equal.
      3. Cable Type – 25 pair copper
         a. Panduit S100X650VAC
         b. or approved equal.
      4. Cable Type – 50 pair copper
         a. Panduit S100X650VAC
         b. or approved equal.
      5. Cable Type – 100 pair copper
         a. Panduit S100X650VAC
         b. or approved equal.
      6. Cable Type – 2 strand fiber
         a. Panduit F100X300AJT
7. Cable Type – 4-12 strand fiber
   a. Panduit S100X125VAC
   b. or approved equal.
8. Cable Type – RG-6 Coax
   a. Panduit S100X125VAC
   b. or approved equal.
9. Cable Type – RG-59 Coax
   a. Panduit S100X125VAC
   b. or approved equal.
10. Cable Bundles
    a. Panduit UIHL12-X0
    b. or approved equal.
11. Other Interior Cabling
    a. Panduit S100X650VAC
    b. or approved equal.

2.2 CLOSET HARDWARE LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
C. Where insert type labels are used provide clear plastic cover over label.
D. Manufacturer:
   1. Copper Patch Panels
   E. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
   F. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
G. Location ID
   1. Manufacturers:
      a. Panduit .3” White C061X030FJC
      b. Panduit .5” White C750X050YIJ
      c. or approved equal.
   2. Non-keystone based fiber patch panels
      a. Panduit .3” White C061X030FJC
      b. Panduit .5” White C750X050YIJ
      c. or approved equal.
   3. 110 blocks
      a. Panduit C750X050YIC.
      b. Panduit .5” White C750X050YIJ
      c. or approved equal.

2.3 GROUNDING AND BONDING, PATHWAY, AND SPACE LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
C. Manufacturers:
   1. Panduit C200X100FJC
   2. or approved equal.

2.4 WORKSTATION LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Location ID
   1. Manufacturers:
      a. Panduit .3” White C061X030FJC
      b. Panduit .5” White C750X050YIJ
      c. or approved equal.

D. Outlet /Jack ID
   1. Manufacturers:
      a. Panduit .3” White C138X019FJC
      b. Panduit .5” White C750X050YIJ
      c. or approved equal.

2.5 NAMEPLATES
A. Field Fabricated Nameplates
   1. Features/Function/Construction
      a. Provide laminated plastic nameplates for each equipment enclosure, rack, switch, and device; as specified or as indicated on the drawings.
      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.
      f. Corners shall be square.
      g. Accurately align lettering and engrave into the core.
      h. Minimum size of nameplates shall be one by 3 inches.
      i. Lettering shall be a minimum of 0.25 inch high normal block style
   2. Manufacturers:
      a. Panduit C300X100APT
      b. or approved equal.

PART 3 - EXECUTION
3.1 GENERAL
A. Verify all room numbers, facility names, building numbers, and utility vault numbers with the University's Representative prior to labeling. Contractor applied labeling shall reflect final space and Telecommunications structure designations.

B. Contractor will be required to coordinate the labeling with the University's Representative and make adjustment where / when necessary at Contractor's expense when submittals and approvals are not received in advance.
   1. Where circuit numbers are indicated on the Contract Documents, Contractor to apply those numbers after first confirming that they remain consistent with the University's current standards.

C. Label cables using the appropriate circuit ID. Label to be Black text on a White background.

D. Use adhesive type labels for all interior communications cable labels.

E. Affix labels to cables – marking cable or other non-machine generated means is not permitted.
F. Apply labeling to clean surfaces free of oil, dust, solvents or loose material.

G. Apply after Project painting in area of application is complete.

H. All jack, patch panel and WAP labels to be sized to match available label locations, labeling windows, pre-defined labeling areas of components unless otherwise directed by the University’s Representative.

I. Cable designation, cable numbers, locations and a running tally of installed cabling shall be continuously updated in each Telecommunications Room during the installation process.

J. Apply to locations where labeling will not be damaged, covered over or in the way of the ordinary maintenance and operation of the installed Telecommunications infrastructure or system.

K. Apply labeling right side up, parallel to major edges of surfaces to which it is applied. When no line is evident, apply parallel to floor line. Correct conditions of labeling applied out of true.

L. Protect installed labeling from damage.

M. Replace labeling that is defaced, faded, illegible or peeling off of the surface to which it is applied.

N. Provide all label information on new layer(s) of respective AutoCAD drawings for each cable, equipment and device being installed.

3.2 IDENTIFICATION & 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. Affix labels to entrance doors – coordinate location with University’s Representative.
   3. At each Telecommunications Room, a copy of the as-built record drawing for the cabling served by the room prepared using Computer Aided Drafting (CAD) to be plotted on an architectural “D” or “E” size on Mylar sheet(s) and permanently fastened to the wall at a location selected by the University’s Representative.

B. Rack & Cabinet Labeling
   1. Provide laminated plastic nameplates for each equipment enclosure, rack, switch, and device; as specified or as indicated on the elevation drawings.

C. Underground Structure including Maintenance Holes, Vaults, Boxes and Underground Pull-through locations
   1. All maintenance holes, vaults and pullboxes must be labeled with a unique number defined by the CAD files and spreadsheet provided by the Universities Representative.
   2. The unique number or identifier must be clearly stamped into the rim or frame of all manholes, vaults and pullboxes. It must be weatherproof, wear-proof, legible, and visible at all times.
   3. All pull through locations that have no ring to identify shall have a stamped plate attached that provides an identifier that is identical to that of a stamped ring.
   4. The number or identifier must be the largest font size that the installer can fit into the rim or frame.
   5. The labeling is to be placed on the South side of the Manhole, Vault and/or Pullbox.
6. The labeling effort is the direct responsibility of the installing contractor placing cabling within a vault, manhole, pullbox structure.

D. Outside Plant Cabling
   1. Within every manhole/vault/pullbox and within 4 ft of the entrance into a building, every backbone cable's assigned identifier shall be affixed to either the cable's outer jacket or to innerduct in which the cable is installed.
   2. Label each building-to-building cable traversing outside the structure with a unique number. A spreadsheet containing the circuit number to be applied to each cable will be provided by the University's Representative.
      a. Existing grandfathered cabling uses conventions 0-100, 01CA XX, 70DTXX.
      b. F2XX through F799 is used for building installations.
      c. 800 through 899 shall be used for fiber tie cables.
      d. 900 series shall be used for the OSP cable of third-party telecommunications utilities including AT&T and Comcast.
   3. Locate labels to maximize viewing by service personnel. If several cables are bundled together or run side-by-side, group all labels.
   4. Where the cables terminate indoors in Entrance Facilities, use the methods described under Indoor Communications Cables below.
5. Example OSP Cable Documentation to be provided by the Contractor

<table>
<thead>
<tr>
<th>CABLE</th>
<th>CABLE SIZE</th>
<th>COUNT</th>
<th>MDF OR SPLICE POINT</th>
<th>SECTION 1</th>
<th>SECTION 2</th>
<th>TERMINATION OR SPLICE POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>F826</td>
<td>18 MM</td>
<td>1-18</td>
<td>Building 42</td>
<td>BLD42 MH 20 PB 15 MH 14 PB 60 MH 29 MH 28</td>
<td>MH 28</td>
<td>BLD 41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-6</td>
<td>Manhole 08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-12</td>
<td>Manhole 08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13-18</td>
<td>Manhole 08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. Indoor Communications Cables
1. Horizontal and Indoor Backbone Cables shall be marked within 12” of each endpoint or to innerduct in which the cable is installed. Label each end of each riser cable where the cable terminates according to the scope of work. Backbone cables shall be marked at each endpoint and at all intermediate locations, pull / access points or junction boxes through which the cable passes, as well as on each floor and in each room the cable is openly visible in.
2. Cable label will be cut and sized to the cable's outer sheath.
3. Locate labels to maximize viewing by service personnel. If several cables are bundled together or run side-by-side, group all labels.
4. Copper Riser Cabling. Labeling of all copper backbone cables of at least 25 pair construction to contain the following information:
   a. Contractor's Name
   b. Installation Date
   c. Cable Type (Example: CMP/24 AWG).
   d. University Assigned Cable ID: (Example: 70 Tie 0P609)
   e. Pair Count (Example: 1-50)
5. Fiber Riser Cabling. Labeling of all fiber backbone cables to contain the following information:
   a. Contractor's Name
   b. Installation Date
   c. Cable Type (Example: OCNP/06 MM/SM)
   d. University Assigned Cable ID: (Example: IFA134)
   e. Strand Construction and Count (SM-1-12)

F. 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 both the pair count of every fiber pair, the cable's assigned identifier, and where shown on the plans, 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:
      i. Fiber Cable #, "FROM" Building / "FROM" Room / "FROM" FTU / Fiber Type / Strand # to Location / Telecom Cable # / "TO" Building / "TO" Room / "TO" FTU / Strand # / Fiber Type

G. Copper Patch Panels
1. If not shown on the Contract Documents, University's Representative will provide specific circuit ID information.
2. Analog Voice patch panels, where indicated,
   a. Label the pair count at the top of the patch panel, separated from all others. Place the cable's identification text (example: 18CA75, TIE 1672A) centered on the top label strip.
3. Other Tie Cable Patch Panels
   a. Provide patch panel labels indicated its function.
   b. Example: "FROM" & "TO" Tie cable labels will be provided by the University’s Representative.

H. 110 blocks
   1. Each cable termination position on 110 blocks shall be labeled with number designators.
   a. All backbone copper cable termination blocks shall be labeled with both the pair count of every 5th pair and the cable’s assigned identifier.

2. Where insert type labels are used install clear plastic cover over reprinted or Laser printed type label.

I. Workstations
   1. 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 1.A (University established designation)
   c. Provide sequential 4 or 5 digit jack number (starting dependent on the floor designation) beginning with a D such as D-X056, X being floor # followed by the closet sequenced cable number.
   d. In certain instances there may be requirements for a “V” designation. This requirement will be for traditional voice services will be defined by University Representative.
   e. Use adhesive type labels and affix labels to faceplate per diagram provided.

J. Faceplate Diagram

K. 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 to be adhered to the Access Point itself.
   2. WAP labeling consists of; the Icon being a designated color at the device, Icon being a designated color in the patch panel, a band being installed on both ends of the patch cord that connects the cable in the closet.
   3. Installers shall label the WAP installation in conformance with the sample below.
   a. Building Designation / room or area designation – AP / a,b,c (if multiple AP’s)
L. Grounding and Bonding
   1. The TMGB (telecommunications main ground busbar) shall be labeled as such with an adhesive type label affix label to TMGB.
   2. The conductor connecting the TMGB (telecommunications main ground busbar) to the ground busbar at the main building electrical service entrance to the building shall be labeled at each end with an affixed label in a visible location as close as practical to the bonding point at each end of the conductor by the Electrical Contractor.
   3. The TGB(s) (telecommunications ground busbar) shall be labeled as such with an adhesive type label(s) affix label(s) to TGB.

M. Firestopping
   1. Each firestopping location shall be labeled at each location where firestopping is installed, on each side of the penetrated fire barrier, within 12 in. of the firestopping material.
   2. Labels shall adhere to the requirements set forth by the authority having jurisdiction. (AHJ)

END OF SECTION 16740
SECTION 16760
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 SCOPE OF WORK
A. Communications racks and cabinets.

1.2 RELATED WORK IN OTHER SECTIONS
A. Section 16705 – Grounding and Bonding for Communications Systems
   1. Bonds racks and cabinets.
B. Section 16710 – Hangers and Supports for Communications Systems
C. Section 16712 – CONDUITS AND BACKBOXES FOR COMMUNICATIONS Systems
D. Section 16790 – Communications Horizontal Cabling
E. Section 16775 – Communications Rack Mounted Power Protection and Power Strips
   1. Installation of rack mounted power strips, protection and distribution units.

1.3 REFERENCES
A. Usage in accordance with Section 01420 - References
B. American National Standards Institute (ANSI)
   1. EIA-310-D (1992) Cabinets, Racks, Panels, and Associated Equipment
      (ANSI/EIA/310-D)
C. Telecordia Technologies
   1. Network Equipment Building System (NEBS) GR-63-CORE.
D. IEEE
E. Underwriters Laboratories (UL)
   1. UL 467 (1993); R 2004 Grounding and Bonding Equipment
   2. Underwriters Laboratories (UL)

PART 2 - PREPARATION

A. Verify that no mechanical, electrical or other systems and piping systems, (eg. water sources) run thru the IDF / IT Closets / or IT spaces

B. Validate the package for the IT installation, eg. Power for equipment, pathway for cabling air conditioning and incidentals for proper operation of each TR.
PART 3 - SUBMITTALS

3.1 SUBMITTALS

A. Conform with the requirements of Section 01330 - Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications.

3.2 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01610 – Product Requirements and Section.

PART 4 - PRODUCTS

4.1 GENERAL

A. KEYS

1. Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically.

4.2 EQUIPMENT ENCLOSURE SYSTEMS

A. General:

1. Provide enclosure systems including, but not limited to enclosures, cabinets, cases and related panels and accessories as specified herein. Provide size and quantity as shown on drawings or scheduled.

2. Provide Black Anodized Provide enclosure systems conforming to the CBC, edition as referenced in Section 01410 - Regulatory Requirements, for seismic design using procedures and means of attachment defined in Section 16012 – Seismic Design.


B. Relay Rack, Integrated Vertical Wire Chase, Seismic Applications

1. Construction

a. Relay rack is manufactured assembly listed by manufacturer as suitable for support of communications systems under the seismic design standards defined Section 16710 - Hangers and Supports for Communications Systems with a least a 500 pound uniformly distributed load.

b. Relay rack assembly shall have California OSHPD OPA preapproval where applicable.

c. Two wide vertical side channels tapped with EIA mounting holes on both sides, 6" deep section construction minimum.

d. Full 19" wide EIA Frame fits standard equipment forms – assemblies with non-standard opening widths not permitted.

e. Floor mount plates

f. Under no circumstances shall hard piped power receptacle be in contact with or affixed to communications rack or cable tray/ladder rack. See specification 16775 for rack power strip requirements. Where possible install power receptacle with flexible service cord and cord cap 3 feet above vertical wire manager opening.

1. 44 EIA Rack Units minimum

h. Vertical Wire Manager

i. Vertical rack mounted wire managers for seven (7) foot racks,

ii. Double sided, ten (10) inch wide minimum

iii. Integral molded plastic slack spools.

iv. Doors dual hinged metal doors front and back required for double sided vertical wire managers, rugged full length doors open 180 degrees for complete access to pathway, color black;
v. Vertical side walls feature large finger openings, accommodating up to 48 category 6 cables ea.

2. Manufacturers, Zone 4 rated rack assembly - subject to minimum panel opening criteria scheduled above:
   a. Hoffman ESDR19FM45U
   b. or approved equal.

3. Manufacturers - Vertical Wire Management System – Provide one complete assembly at each assembly of each rack (two per rack), unless otherwise indicated on the plans
   a. Panduit Vertical Wire Management Assembly.
      i. PEV Series full height vertical cable manager
         (1) PEV10 10" Wide Front/Back unless otherwise noted on plans
      ii. At least four PRSP5 slack spools per vertical cable manager,
      iii. PED Series dual hinged metal door installed at front face of vertical wire manager
         (1) PED10 10" Wide door unless otherwise noted on plans
      iv. Panduit PREP end panels at ends of rack rows.
   b. or approved equal.

4. Data Center application overhead trough, Manufacturers,
   a. Panduit FT2X2YL
   b. or approved equal.

4.3 RACK PANELS AND ACCESSORIES

A. Rack Mounting Screws:
   1. Screws 10-32; length as required for at least 1/4" excess when fully seated; oval head with black plated; Phillips, Slotted screws are acceptable. Self-Tapping screws are not acceptable.

PART 5 - EXECUTION

5.1 MOUNTING

A. Unless otherwise noted, all floor supported equipment racks shall be bolted to the structure in accordance with the requirements of the CBC and the UBC.

B. Contractor shall install per approved structural engineering design illustrating the materials approved that conform to these requirements.

C. Rows of identical racks shall be bolted together with rack managers between, in addition to being bolted to the floor, and individual bond cables to form a single electrical ground plane.

D. Leave a minimum of 12 inches of separation between cable tray and 2 and 4 post racks.

E. Leave 3 inches of separation between ladder rack and 2/4 post racks.

F. Wall mounted equipment racks and cabinets shall similarly be bolted to structural members in accordance with the requirements of the CBC, the UBC and the contractors approved structural engineering submittal demonstrating the method to be used to conform to these requirements.

5.2 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.
B. Provide permanent labels for all equipment and devices, see Section 16740.

C. Floor racks to be bolted to floor unless otherwise indicated.

D. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

E. Provide a label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

F. Where wiring of mixed types (Coax / Cat 5&6) are called for on the plans, maintain separation of wiring classifications as specified in the individual sections of the Communications Work.

G. Provide physical separation between station cables from different floors, keeping cables from each floor grouped together. See Elevation drawings provided by UC Representative.

H. Provide vertical wire management of cabling within the mounting rails. Dress and cabling at a minimum of 24 inch on center within the rack and cabinet.

I. Access shall not require demounting or de-energizing of equipment or cabling. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

J. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.

5.3 SIGNAL GROUNDING & BONDING PROCEDURES

A. Comply with National Electrical Code and the California Electric Code. Bond equipment racks to ground in accordance with the California Electric Code and ANSI/ EIA/ TIA 607-B and Section 16705 – Grounding and Bonding for Communications Systems.

B. See section references for grounding details

END OF SECTION 16760
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install shielded metal modular patch panels for data and voice WAO cables. Furnish and install Cisco blade wiring harnesses and terminations. Furnish and install fiber optic patch panels and connectors. Mount all patch panels and customer provided electronics in floor mounted equipment racks.

B. This Section defines material standards for:
   1. Copper Termination Assemblies, including
      a. Rack and cabinet mounted copper patch panels
      b. Rack and cabinet mounted network switch distribution patch panels
      c. Backboard, rack and cabinet mounted terminal blocks
   2. Fiber Termination Assemblies, including:
      a. Fiber connectors
      b. Rack and cabinet mounted fiber patch panels

1.2 RELATED WORK UNDER OTHER SECTIONS

A. Section 16700 – Common Work Results for Communications
B. Section 16705 – Grounding and Bonding for Communications Systems
C. Section 16710 – Hangers and Supports for Communications Systems
D. Section 16740 – Identification for Communications Systems
E. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
F. Section 16770 – Communications Cable Management
G. Section 16790 – Communications Horizontal Cabling

1.3 REFERENCES:

A. Usage: In accordance with Section 01420 – References.
   1. ELECTRONIC INDUSTRIES ALLIANCE (EIA)

1.4 SUBMITTALS

A. Conform to the requirements of Section 01330 - Shop Drawings, Product Data and Samples and Section 16700 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01610 - Product Requirements.

1.6 SEQUENCING

A. Not Used.
PART 2 - PRODUCTS

2.1 COPPER CABLE TERMINATION DEVICES AND RELATED

A. MPOE Category 6 Terminal Block.
   1. General: Insulation displacements connector blocks consisting of oxygen free mechanical fastening system arranged in a flame-retardant molded plastic fastened to a mounting bracket.
   2. Features/Functions
      a. “110 type” punch down type.
      b. Cable routing space behind the blocks.
   3. Conforms with REA PE-87.
   4. Performance:
      a. Complies with Pan-Punch®110 Punchdown System Specifications
      b. Electrical (measured at 50 MHz).
      i. Resistance: Not more than .4 ohms/termination
      ii. Inductance: Not more than 13 nH/termination
      iii. Capacitance:
            (1) Not more than .9 pF/termination, same pair.
            (2) Not more than .7 pF/termination, next pair.
   5. Construction/Implementation
      a. Provide complete tower system including legless terminal blocks mounted to a three sided steel frame standoff mounting bracket.
      i. Bracket is affixed to the backboard.
      ii. Terminal blocks are affixed to the mounting bracket frame.
      b. Provide steel cross-connect management trough at the bottom of each column of blocks, extending perpendicular out from the backboard to at least the depth of the bracket supported blocks mounted above, and provided with an upturned lip to retain cross-connect wiring and to protect Telecommunications Room occupants from sharp edges.
      c. Unless otherwise noted, provide WMP between each column of blocks, and at the outside edges of each group of block columns.
   6. Manufacturer:
      a. Panduit GP6™ PLUS Standard Density Tower Kit
      i. 288 pair: GPKT724Y
      ii. Leviton 41880-300 & 41NB6-1FU
      iii. Ortronics OR-806003197 & OR-110PBC6300

B. Rack Mount Category 6 8P8C
   1. Drawing reference
   2. Construction
   3. CP48WSBLY 19" rack panel.
      a. Or equal
   4. Manufacturer
      a. Panduit
      b. Or approved equal

C. Data Patch Panels, Category Insert, All metal shielded Modular patch panels.
   1. Drawing Reference(s): None.
   2. Functions/Features:
      a. 19" EIA rack mountable.
      b. At least 48 ports per EIA rack unit (3.47").
      c. Jacks are modular, with any of the specified jacks able to occupy any of the openings in the patch panel, and any jack that is damaged can be pulled for service without dislodging jacks in service to either side of it.
      d. Jack opening size conforms to the dimensional requirements of Section 16790 - Communications Horizontal Cabling.
e. Installed jacks match the color code of the jack at the opposite end of the circuit.

f. Patch panel provides patch panel and port identifier label space on front – label per Section 16740 - Identification for Communications Systems.

g. Each opening to be filled with Category 6 jacks as specified in Section 16790 - Communications Horizontal Cabling.

3. Manufacturers

a. Panduit CP48WSBLY

b. Ortronics OR-PHDPJU48

D. Switch Distribution Patch Panels (Plug Pack)

1. Drawing Reference: None

2. Minimum Features/Functions/Construction:

a. Switch patch provides breakout of University standard Cisco core switch outputs to rack mount angle patch panels without introducing an extra patch point for the purposes of ANSI/TIA 568.

b. The rackmount distribution panel to be installed in the rack above the University furnished data networking switch and shall be of a 1U angled panel design with alternating 1U spacing panels.

c. The configuration shall be one 1U angled patch panel, one spacer followed by an identical set of units until the full complement of available Cisco Blade Slots are accounted for in the build. Contractor to assume at least 384 Ports of breakout are required at each Telecommunications Room, unless otherwise noted.

d. Color of distribution jacks to be black.

e. Plug meets all applicable FCC part 68 Subpart F requirements and exceeds IEC 60603-7 specifications.

f. Connecting cabling to be of a pre-manufactured UTP construction meeting Category 6 transmission standard, and NEC listed CMR or CMP. Color: Black.

g. Each plug pack cable is to be 100% performance tested.

h. In addition each cable is to be tested for verification that port one is assigned to network blade port one on each patch panel.

i. Provide test results and register with the manufacturer for manufacturer warranty

3. Manufacturers:

a. Panduit

i. One RU Angled 48 port Patch Panels: CPPA48HDWBLY

ii. One RU Angled filler panels: CPAF1BL

iii. Quicknet Plug Housing accepts 12 RJ45 modular plugs.

iv. Category 6A TX6A black patch cords, Panduit UTP6axBL. Lengths to be determined by installation contractor

v. Category 6A TX6A black modular jacks, Panduit CJ6X88TGBL.

vi. Contractor shall coordinate all part numbers with Panduit.

b. or approved equal (no known equal).

2.2 FIBER CABLE TERMINATION DEVICES AND RELATED:

A. Fiber Optic Connectors and Related:

1. General

a. Connectors to comply with:

i. EIA/TIA-4750000-C

ii. EIA/TIA-604-3A

2. Fusion Splice System

a. Provide fusion splices only - mechanical splices not permitted.

b. Insertion Loss:

i. $\leq 0.03$ dB - manufacturer’s rating for typical splice – multimode
ii. \( \leq 0.06 \text{ dB} \) - manufacturer’s rating for typical splice – singlemode.

c. Manufacturer
  i. Corning Cable Systems Model X77 Micro Fusion Splicer
  ii. AFL Telecommunications.
  iii. or approved equal.

3. Connectors Multi Mode:
   a. LC at rack mounted patch panels as noted or scheduled, LC’s permitted at work area outlet locations.
   b. Physical Characteristics:
      i. Have a buffered fiber version consisting of 2 parts (connector housing and boot).
      ii. Have a jacketed fiber version consisting of 3 parts (connector housing, crimp sleeve, & boot).
      iii. Have the jacketed fiber version available with either blue or a white boot (to facilitate fiber identification).
      iv. Have a radial-ramped coupling nut, which facilitates mating/demating.
      v. Utilize a precision zirconia ceramic ferrule.
   c. Connector performance per TIA/EIA-568.C.3 and the following.
      i. Insertion Loss:
         (1) Multimode:
            (a) Less than or equal to 0.75 dB per mated pair
      ii. Return Loss
      iii. Manufacturer:
         (1) Connector Panduit
            (a) FLCSMEIY: LC Multimode 2mm jacketed or 900µm tight-buffered, Ivory Boot
            (b) FSCMBL: SC Multimode 3mm jacketed or 900µm tight-buffered, Black Boot
            (d) Or approved equal
            (e) 

4. Connectors Single Mode
   a. Fusion spliced pre manufactured corning or Siecor
   b. Physical Characteristics:
      i. Have a buffered fiber version consisting of 2 parts (connector housing and boot).
      ii. Utilize a precision zirconia ceramic ferrule.
   c. Connector performance per TIA/EIA-568.C.3 and the following.
      i. Insertion Loss:
         (1) Singlemode, Ultra Polish
            (a) Less than or equal to 0.50 dB per mated pair
         (2) Singlemode, Angle Polish
            (a) Less than or equal to 0.30 dB per mated pair
      ii. Return Loss
         (1) Singlemode, Ultra Polish, greater than or equal to 55 dB
         (2) Singlemode, Angle Polish, greater than or equal to 65 dB
      iii. Manufacturer:
         (1) Connector Panduit
            (a) FLCSMEIY: LC Multimode 2mm jacketed or 900µm tight-buffered, Ivory Boot
b) FLCSSBUY: LC Singlemode 2mm jacketed or 900µm tight-buffered, Blue Boot

c) FSCMBL: SC Multimode 3mm jacketed or 900µm tight-buffered, Black Boot

d) Or approved equal

5.

(a)

B. Fiber Distribution Panels, Splice and Patch.
1. Drawing References: None
   i. FDP - Splice and Patch Panel

2. Features/Functions/Performance:
   a. 19" EIA rack mount.
   b. Suitable for housing fiber optic mechanical splices in a neat and orderly fashion.
   c. Stores a minimum of one meter of cable without kinks or twists.
   d. Provides individual strain relief for each splice.
   e. Suitable for re-entry, if required for future maintenance or modification, without damage to the cable or splices.
   f. All required splice organizer hardware, such as splice trays, and shield bond connectors shall be provided.
   g. Incorporates cable tie downs and routing rings.
   h. Provides a location for splice, maintenance and cross-connecting of fiber optic cables.
   i. LC front panel patch connector - color yellow at singlemode strands and color blue at multimode strands. Provide manufacturer’s blank cover inserts at unused openings.
   j. High Density - At least 24 patches in 3 rack units.

3. Manufacturer:
   a. Panduit Opticom FRME4U Rack mounted fiber optic enclosures with FAP6 Series and FAP12 Series Fiber Optic Adapter Panels and FMP6 Blank Panels in quantities as required
   b. or approved equal by Leviton or Ortronics.
   c. Refer to Panduit specifications when providing equals.

C. Wire Center, High Density Fiber Distribution Locations-Per Customer Definition
1. Drawing References: None
   i. FDP - Splice and Patch Panel

2. Features/Functions/Performance:
   a. 19" EIA rack mount.
   b. Suitable for housing fiber optic splice trays in a neat and orderly fashion.
   c. Stores a minimum of one meter of cable without kinks or twists.
   d. Provides individual strain relief for each splice.
   e. Suitable for re-entry, if required for future maintenance or modification, without damage to the cable or splices.
   f. All required splice organizer hardware, such as splice trays, and shield bond connectors shall be provided.
   g. Incorporates cable tie downs and routing rings.
   h. Provides a location for splice, maintenance and cross-connecting of fiber optic cables.
   i. LC front panel patch connector - color yellow at singlemode strands and color blue at multimode strands. Provide manufacturer’s blank cover inserts at unused openings.
   j. High Density - At least 24 patches in 3 rack units.

3. Manufacturer:
a. Corning FCE4U Rack mounted fiber optic enclosures with FAP12 (LC) Series Fiber Optic Adapter Panels (FAP12XXXXLCZ ). Provide FMP6 Blank Panels in quantities as required
b. or approved equal

PART 3 - EXECUTION

3.1 SWITCH PATCH PANELS

A. Provide and install wiring harnesses to support twice as many cables as are to be installed.

B. Consult and co-ordinate this portion of the installation with University's Representative before beginning work. The University's Representative will advise contractor who is to perform the installation of UC provided Network Equipment, plugging in wiring harness, and dressing of cables into the Cisco blades. Provide labor on Base Bid with Network Equipment installation work.

C. Wiring harnesses consist of four bundles of 12 each, category 6 cables. These 48 cables, each having 4 pair of conductors within, provide continuity from a Cisco switch port to a patch panel port. Each individual Cat 6 cable shall be terminated on one end with a male 8P8C and female 8P8C on the other. The male 8P8C of this Cat 6 cable is in turn inserted into what is called a “plug pack”. The plug packs are to be able to hold groups of 6 cables, which are then plugged into a Cisco blade. The female end of this Cat 6 cable is then placed into a patch panel. These female ends shall be installed in sequential order in a “V” shaped patch panel. This “V” shaped patch panel is then placed in a 19” rack with an accompanying “V” shaped blank panel to obtain a one RU separation between harness patch panels.

D. Each group of cables is comb dressed from the Cisco chassis to the patch panel in a clean, tidy, and workmanlike manner while avoiding restriction to operating functionality for the surrounding equipment. Specifically avoiding the restriction to opening the fan and filter tray/door of a Cisco chassis, where this condition exists, is required. Refer to University Representative for make and model of equipment being installed.

E. Test each cable pair for conductivity and cable orientation prior to completing the harness installation using the manufacturer’s breakout kit for this purpose.

F. Install corresponding UC provided Network Equipment in the Telecommunications Room rack in the indicated location. Contractor to assume equipment will need to be retrieved from the University's warehouse. Provide a notification, one day prior to pick up and installation.

G. Contractor shall not apply power to the University's Network Switch.

H. Ground connections shall be verified by use of VOM, verifying removal of paint and other insulators restricting conductivity.

I. Provide and install one NM4 wire manager above each of the chassis or switches and cable management provided with the rack.

3.2 CROSS CONNECT FIELD (VOICE CABLE):

A. Analog cabling shall be terminated on RJ45 patch panels on Blue jacks unless otherwise directed in the scope of work.

B. Tie and riser cables shall terminate on RJ45 patch panels on Blue jacks, two pair per jack, unless otherwise directed in the scope of work.
C. VG224 Equipment cabling shall be a single pair terminated on RJ45 patch panels on Blue jacks unless otherwise directed in the scope of work.

D. Alarm station cabling shall terminate on RJ45 patch panels on Blue jacks unless otherwise directed in the scope of work.

E. Label the pair count at the top of the patch panel, separated from all others, beginning at one through pairs 48 of the respective count or 51 through 98 of the respective count. Place the cable's identification text [18CA75, TIE 1672A, or similar] also on the top label strip and center. Refer additionally to Section 16740 - Identification for Communications Systems.

END OF SECTION 16765
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section includes provision of cable management for cabling installed under the work of this Project as well as for Contractor furnished patch cords at equipment racks

B. Scope includes:
   1. Innerduct
   2. TR / ER Backboard
   3. Cable End Spillway
   4. Vertical wire management
   5. Horizontal wire management
   6. Rack cable management
   7. Pathway Fill ratios
   8. Conduit fill ratio
   9. Copper Patch Cord
   10. Fiber Patch Cord
   11. Backboard Cable Management
   12. Cable Tray Cable Management
   13. Cable Rack Cable Management
   14. Patch Panel Cable Management
   15. EMI separation

1.2 RELATED WORK IN OTHER SECTIONS

16. Section 16700 – Common Work Results for Communications
17. Section 16705 – Grounding and Bonding for Communications Systems
18. Section 16710 – Hangers and Supports for Communications Systems
19. Section 16740 – Identification for Communications Systems
20. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
21. Section 16765 – Communications Termination Blocks and Patch Panels
22. Section 16790 – Communications Horizontal Cabling

1.3 REFERENCES

C. American Society For Testing and Materials (ASTM)
   1. ASTM D2239-03 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

D. Underwriters Laboratories (UL)
   1. UL 910 Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air (Nov. 1998)

E. In addition to the requirements of Section 16700 - Common Work Results for Communications and 16754 - Structured Cabling, conform to the applicable portions of the following standards agencies:
   1. BICSI
   3. Insulated Cable Engineers Association (ICEA)
4. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009
5. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009


J. FCC Title 47 CFR Part 15

1.4 SEISMIC DESIGN REQUIREMENTS
   (1) N/A

1.5 SUBMITTALS
   A. Conform with the requirements of Section 01330 – Provide Product Data Sheets, Shop Drawings if applicable. Provide Samples if an “or Equal” product is to be recommended by the vendor.

   B. Section 16700 - Common Work Results for Communications

1.6 DELIVERY, STORAGE AND HANDLING
   C. Procedures: In accordance with Section 01610 – Product Requirements.

PART 2 - PRODUCTS

2.1 BACKBOARD CABLE MANAGEMENT
   1. ¾ inch fire rated, painted plywood
   2. Install to surround each TR / ER per Construction Specification #

2.2 INNERDUCT
   A. Innerduct, Single Chamber –
      1. Drawing and spec reference(s):
         a. ID*, Innerduct (“*” denotes cross sectional area of innerduct referenced to standard conduit trade size).
         IDP*, Innerduct, Plenum (“*” denotes cross sectional area of innerduct referenced to standard conduit trade size
      2. Manufacturers, ID in underground ductbanks:
         a. Carlon Optic-Gard/PE.
         b. Arnco.
         c. or approved equal.
3. Manufacturers, ID in interior, non-plenum applications:
   a. Carlon Optic-Gard/PVC.
   b. Arnco.
   c. or approved equal.
4. Manufacturers, IDP:
   b. Arnco.
   c. or approved equal.

2.3 CONDUIT SPILLWAY

A. Conduit transitions
   1. Features/Functions when cable spilling onto cable tray
      a. Spillway fastens to end of EMT conduit, provides radius sweep, open on
         top, solid from below
      b. Maintains proper bend radii for fiber/cable
      c. maintain UL fire system rating
      d. Supports applicable weight of fiber and or copper cable transitioning into
         and out of conduit structure
      e. Fits up to 4” EMT conduit end.
   2. Construction:
      a. Fire Retardant ABS
   3. Manufacturers:
      a. Panduit CWF400
      b. Or equal

2.4 CONDUIT END WALL TRANSITION

1. Features/Functions when being secured to a wall
   a. Waterfall to ladder
   b. Secure cables every 24 in
   c. maintain UL fire system rating
   d. fasten directly to stud
2. Construction:
   a. ¼’ X 2 ½ Lag Bolt
   b. ¼ X 2 ½ Toggle Bolt
3. Manufacturers:
   a. B-Line Telecom-Saunders SB-17.SB2114-AFB
   b. Chatsworth Products Inc. 11275 series.& 10608-701
   c. or equal.

2.5 CABLE TRAY WATERFALL

1. Provide cable tray waterfall or drop out
2. Cooper B-line 9A-1104
3. Cooper B-line 99-1124
4. Or Equal

2.6 CABLE TRAY TRANSITIONS

1. All turns, bends, and direction changes shall use manufacturer’s pre-
   manufactured materials.
2. Vented trough engineered rounded transitions such as Cooper B-line 4AVT-12-90-HB-24 shall be accepted

2.7 CABLE TRAY DIVIDER

1. 73A-90HBFL
2. Or equal

2.8 BASKET TRAY WATERFALL

1. Provide cable tray waterfall or drop out
2. Panduit WGBTMWFB (side) WGSDWWF4_BL
3. B-line WB06-DO (8 or 12)
4. Panduit WGBTMWFB (side) WGSDWWF4_BL
5. Wire Basket Tray, WB2DO
6. OR EQUAL

2.9 BASKET TRAY INTERNAL BEND
1. Panduit GRBRC(x) PG- (x = inches) PG
2. WB2RSPL
3. OR EQUAL

2.10 BASKET TRAY RAIL RISER
1. WB2RR
2. Or equal

2.11 BASKET TRAY DIVIDER
1. Wb2b-3m
2. Or equal

2.12 J HOOK CABLE MANAGEMENT
1. As per 16710

2.13 HORIZONTAL WIRE MANAGER
A. Patch Panel Wire Management, Rack Mounted, Dual Hinged, semi attached Snap Cover.
   1. Continuous flexible system of fingers and slots along top and bottom of patch panel, deburred to avoid snagging patch cord jacket.
   2. Dual Hinged, semi attached Snap Cover
   3. Provide 4 RU assembly at the center of each rack or as provided in UC provided rack elevations
4. Manufacturers – 1 RU
   a. Panduit NM1.
   b. or approved equal
5. Manufacturers – 2 RU:
   a. Panduit NM2.
   b. or approved equal
6. Manufacturers – 4 RU:
   a. Panduit NMF4.( NM4 where applicable)
   b. or approved equal

2.14 VERTICAL WIRE MANAGEMENT
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. Size Specified by University Representative, refer to elevations
   a. Panduit PEV’s
   b. or approved equal

2.15 PLUG PACK
   c. See Section 16765

2.16 COPPER PATCH CORDS (REFERENCE STATION CORDS IN SPECIFICATION 16790 )
A. Category 6 copper Patch Cords
   1. Minimum Features Functions Performance:
a. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes.

b. Round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.

c. Equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.

d. Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 micro inches minimum of gold plating over nickel contacts.

e. Resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.

f. Available in any custom length and standard lengths of (3, 5, 7, 10, 14, 20, and 25 feet).

g. Manufactured by an ISO 9001 Certified Manufacturer

h. Comply with TIA 568 C.2 for cable performance

i. Have an input impedance without averaging: 100 W + 15% from 1 to 100 MHz, + 22% from 100 to 200 MHz and + 32% from 200 to 250 MHz.

j. 100% transmission tested for performance up to 350 MHz. Manufacturer shall guarantee cords are compatible with proposed Cat-6 links.

k. Utilize cable that is UL VERIFIED (or equivalent) for TIA Category 6 electrical performance

l. Approvals: UL 1863.

2. Color, Patch Cords: White

   a. All cable jack colors shall be matched with a corresponding patch cord color CIPRD plastic band identifiers.

3. Manufacturers:

   a. Panduit TX-6 Patch Cords with such as CIPRD plastic band identifiers.

   b. Or approved equal

1.3 FIBER PATCH CORDS

   a. Shall meet or exceed standards as defined in ANSI/TIA/568-B.3.

   b. Utilize duplex optical fiber cable that is 9/125 micron singlemode, OFNR riser grade, and meets the requirements of UL 1666.

   c. Color: cable jacket color for 9/125 is Yellow.

   d. SC or LC fiber connector accordance with ANSI/TIA-568-B.3 and must include a ceramic ferrule.

   e. Terminated connectors exhibit a maximum insertion loss of 0.30 dB with an average of 0.25 dB when tested at either 1310 nm or 1550 nm wavelengths for 9/125 mm.

   f. Minimum return loss of 55 dB.

   g. Manufactured by an ISO 9001 Certified Manufacturer.

   h. Approvals: UL 1666.

   i. When specified, MM as per UC representative request

   j. Panduit OPTI-CORE 1.5 mm cords

   k. Or approved equal

   l. See University representative for MM specifications if required

PART 3 - PREPARATION

A. Upon initial bid award an initial meeting shall be conducted with IT facilities representative to organize TR/ER closet layout and expectations.
B. At a period two weeks prior to the installation of racks, mounting of surge protection or termination of cabling, the cabling vendor shall initiate a meeting thru project management to confer with the University on closet set up and materials to be used.

C. Necessity of submittals shall be determined upon the initiation of a field meeting between an IT representative and the vendor providing the installation. Encumbrance upon the vendor to provide incidental materials in the form of a submittal shall be released in the form of an official E-mail from IT Facilities following this field meeting if applicable.

D. In the event that IT facilities determines that a submittal is required the materials shall be outlined in the correspondence conveyed between UC and vendor representatives.

E. Coordination with other trades and project management to determine ownership for use, including marking of the conduits and spaces is the sole responsibility of the cabling contractor.

F. The cabling vendor is responsible to manage cable quantities and validate the pathway provided for fill ratio. If a determination is made that the pathway is deficient, the vendor shall initiate an RFI to the Universities’ representative for resolution.

PART 4 - INSTALLATION:

4.1 BACKBOARD CABLE MANAGEMENT
Install where cabling support or restraint is required to maintain materials in place

3.2 EQUIPMENT RACK
1. Manage horizontal cabling being installed into the equipment rack thru the center trough of the Hoffman seismic rack.
2. Orient front of equipment rack (Top cable management dictates “Front”) facing direction provided in drawings. Support surface for running jumpers on a Hoffman rack shall be facing the front of the rack.

4.2 INNERDUCT
Innerduct
1. Required when virgin fiber patch cords are required to traverse racks, cabinets or spaces that are void of protected spaces
   i. Install in a parallel with other innerduct or like materials
   ii. Maintain applicable bend radius for materials being supported
   iii. Fill ratio to remain below 60%

3.3 CONDUIT TRANSITIONS
2. Required where all conduit structures end, bend or turn within the building or structure.

4.3 CABLE TRAY, CABLE RUNWAY AND BASKET TRAY
1. Specification 16710 and specification 16714 in conjunctions with other related specifications as stated shall govern the installation of cable supporting materials within the confines of this project.
2. Requirements of the cabling being supported shall govern the direction, spacing and in conjunctions with the requirements of other mechanical systems govern the locations of the supporting structure.

B. Cable tray transitions
1. Required where all cable tray ends, bends or turns within the building or structure.
C. Cable tray Divider
   1. Applicable when AV signaling, Analog transmission, bonding or any type of power that shares this raceway.

D. Basket Tray Waterfall
   1. Provide cable tray waterfall or drop out where applicable

E. Basket Tray Bend Radius
   1. Provide applicable cable tray bend radius for the type of materials being installed

F. Basket Tray Riser
   1. Provide cable tray rail riser where fill ration warrants additional cabling support

4.4 J HOOK CABLE MANAGEMENT
   1. Per Section 16710

4.5 HORIZONTAL WIRE MANAGEMENT
   2. Install one Patch Panel Wire Manager, Rack Mounted, Hinged, semi attached Snap Cover on both Top and bottom of each station cabling horizontal patch panel.
   3. Install per elevations provided by University Representative.

4.6 VERTICAL WIRE MANAGEMENT
   4. Install two vertical wire managers per rack installed.

4.7 PLUG PACKS
   5. Install as per elevation and/or applicable SOW provided by University Representative.

4.8 PATCH CORDS (REFERENCE STATION CORDS IN SPECIFICATION 16790)
   A. Category 6 copper Patch Cords
      1. Install one category 6 patch cord per device allocated in the project.
      2. Patch from Network port allocated for the device to the data cable assigned by University Representative.
      3. All Patch cords are to be white in color

   B. Fiber Patch Cords
      1. Provide per Network Required dimension, eg, SM, 62.5, 50 micron etc.
      2. Install one paired fiber patch cord per circuit allocated to the project.
      3. Patch from Network port allocated for the device to the data cable assigned by University Representative
      4. Two Circuits are installed from Campus distribution to building distribution in a redundant fashion.
      5. Two Circuits are installed from Building distribution to building switches in a redundant fashion.
      6. Building distribution is tied within the structure in a redundant fashion.
      7. Provide innerduct on pathway

PART 5 - EXECUTION

5.1 BACKBOARD CABLE MANAGEMENT
   A. Wire Management Rings, Wall Mounted:
      1. Drawing References/Functions Features:
         a. Bridle Ring Type, Threaded Lag Screw
         b. Closed Ring, U shaped assembly with two screw holes at ends,
         c. Open, Re-enterable Split Ring permitting cables to be inserted midspan, two screw holes at ends
3.4 EQUIPMENT RACK

1. Manage horizontal cabling being installed into the equipment rack thru the center trough of the Hoffman seismic rack in a manner to optimize the space available.

2. Ground / bond equipment rack and all equipment installed within per 16705

3. Manage grounds through rear of wire managers with power or data cabling, do not install with data patch cords or fiber patch cords.

4. Power distribution shall be installed in the rear of the rack providing separation from copper patch cords and data cabling.

5.2 INNERDUCT

A. Schedule of Application

B. Conduit
   a. At 4’ (ID) and larger conduits or ducts, place innerduct before placing fiber and copper cabling.
   b. Omit innerduct at conduits 4” or smaller

B. TR / ER
   a. Fiber optic patch cord traversing ladder rack
   b. Fiber optic patch cord traversing cable tray
   c. Fiber optic patch cord to or on back board
   d. Fiber optic patch cord racks or cabinets where cord is not in a protected environment

5.3 CONDUIT END WATERFALL

2. Fasten securely to conduit end wherever cabling will exit conduit 18" or more above the cable tray to prevent damage due to cabling due to weight of cable bearing on a conduit end.

3. Secure cabling with integral cable restraint system only as a means of support.

4. Bend radius for copper patch cords and/or CAT6 data cables shall not be less than 4 times the diameter of the cable or the established BICSI minimum.

5. Maintain Minimum Radii Fiber Optic cable for Copper Feeder Cable 10 X diameter

5.4 CABLE TRAY, CABLE RUNWAY AND BASKET TRAY

a. All turns, bends, and direction changes shall use manufacturers premanufactured materials.

b. Use of cable pathway shall be professional and respective of other trades requiring cabling support by confining cable types to separate sections of tray.

c. Where Category 5, 5E, 6, 6A etc. cables are installed within the confines of a support structure they are to be separated from sources of EMI as re other types of cabling to be separated from these defined structured cables EMI.

d. Cables supporting raw analog and/or video signaling in the form of Coax Cables, VG224, RS422, card key, 70 volt audio systems, grounds /bonds, etc. are to be physically separated from cabling transporting Ethernet signaling.

e. All cabling for services installed at UCDHS is required to accept all interference without malice

f. Initiating permanent separation of service which may be subject to EMI is the responsibility of the vendor whose equipment is subject to
interference, within the confines of FCC regulation.

g. Spacing for proper operation is the responsibility of each discipline and installer.

h. Labeling of a cable to maintain separation is the responsibility of the installer.

i. Adherence to fire code is, but not limited to being the explicate responsibility of the installer at the time of installation.

j. Provide with a complete system of accessories, including radiused corners at vertical and horizontal bends, section splice plates, expansion plates, blind-end plates, etc.

k. Provide waterfall drop-outs at each end of cabling racks and cabinets indicated on the plans scheduled or indicated to terminate open wiring systems.

l. Provide smooth and consistent support where available and practical when providing cabling support.

m. Finishes are to be matched where applicable such as TR / ER rooms where hardware is a Black powder coat.

n. Bend radius for copper patch cords and/or CAT6 data cables shall not be less than 4 times the diameter of the cable or the established BICSI minimum.

o. Bend radius for copper feeder cables shall not be less than 10 times the diameter of the cable or the established BICSI minimum.

p. Bend radius for fiber cables and fiber patch cords shall not be less than 10 times the diameter of the cable or the established BICSI minimum.

C. Cable Tray / Basket Tray cable management

1. Do NOT Tie Wrap Cables
2. Do NOT Secure cables to cable tray unless required to hold in place
3. Do NOT comb cables
4. Secure cables in cable tray only when visual fill ratio exceeds 100 % secure only to maintain load evenly dispersed within tray in a pyramid like fashion
5. Do not secure power outlets to these surfaces

D. Ladder Rack Cable Management

1. Do NOT Tie Wrap Cables
2. Secure cables every 24 inches with Velcro when in TR or ER rooms
3. Do NOT comb cables, organize in a manner that removes divers, eg. out of place data cables.
4. Secure cables in ladder rack when visual fill ratio exceeds 100 % secure only to maintain load evenly dispersed within tray in a pyramid like fashion
5. Do not secure power outlets to ladder racks

5.5 J HOOK CABLE MANAGEMENT

1. Cables are to be consistently grouped together with like systems cabling (Fiber / AV / Copper / Feeder / Etc. )
2. Cables shall not experience any undue or extraneous linear stress (don’t stretch the cables in the Hooks)
3. Cables shall only be exposed to atmospheric pressures and those of the weight of the bundle intended for installation within the guidelines of the hook design. Sag shall not exceed one foot between hooks.
5.6 HORIZONTAL, PATCH PANEL MANAGEMENT OF PATCH CORDS

E. Provision for the management of patch cables to be used to connect each Data Cable jack at the patch panel port to an associated network device.

F. Count the maximum number of data cables that could be installed in the rack configuration provided by UC Representative, and the maximum number of network ports that could be installed. Validate and balance space in wire management to provide for a maximum of 90% patch cord fill ratio.

G. Bend radius for copper patch cords and/or CAT6 data cables shall not be less than 4 times the diameter of the cable or the established BICSI minimum.

H. Bend radius for fiber cables and fiber patch cords shall not be less than 10 times the diameter of the cable or the established BICSI minimum.

I. Patch Panel Wire Management, Rack Mounted, Hinged, semi attached Snap Cover.

1. Continuous flexible system of fingers and slots along top and bottom of patch panel, deburred to avoid snagging patch cord jacket.
2. Hinged, semi attached Snap Cover
3. Patch Cord Capacity @ 50% fill
   a. 1 RU - accommodates at least 24, @ .25 in Dia
   b. 2 RU - accommodates at least 78, @ .25 in Dia
   c. 4 RU – accommodates at least 224 @ .25 in Dia.
4. Provide 4 RU assembly at the center of each rack or as provided in UC provided rack elevations

5.7 VERTICAL WIRE MANAGEMENT

A. Provision for the management of Data Patch cords, fiber patch cords and power distribution strips.

J. Count the maximum number of data cables that could be installed in the rack configuration provided by UC Representative, and the maximum number of network ports that could be installed. Validate and balance space in wire management to provide for a maximum of 90% patch cord fill ratio. (Include Plug Pack cabling in ratio calculation)

B. Provide 100% transition pathway for cables to connect network output locations to in wall Ethernet cabling.

K. Bend radius for copper patch cords and/or CAT6 data cables shall not be less than 4 times the diameter of the cable or the established BICSI minimum.

L. Bend radius for copper feeder cables shall not be less than 10 times the diameter of the cable or the established BICSI minimum.

M. Bend radius for fiber cables and fiber patch cords shall not be less than 10 times the diameter of the cable or the established BICSI minimum.

5.8 PLUG PACKS

1. Validate the position of each cable in the plug pack assembly if not preassembled
2. Test & Record all cable results
3. Register for warranty
5.9 PATCH & STATION CORDS (REFERENCE STATION CORDS IN SPECIFICATION 16790)

A. Category 6 copper Patch Cords (OFOI)
   a. Provide Patch cord sufficient to patch network port to Data Jack with a minimum of a 3 inch slack loop.
   b. Provide no more than 2.0 feet of slack per cord
   c. Bend radius for copper patch cords and/or CAT6 data cables shall not be less than 4 times the diameter of the cable or the established BICSI minimum.
   d. Panduit TX-6 Patch Cords identified with a CIPRD plastic band identifier to match service provided, see 16740.

B. Fiber Patch Cords
   a. Provide Patch cord sufficient to patch network port to Data Jack with a minimum of a 3 inch slack loop.
   b. Provide no more than 2.0 feet of slack per cord
   f. Bend radius for fiber cables and fiber patch cords shall not be less than 10 times the diameter of the cable or the established BICSI minimum.
   g. Label according to section 16740

PART 6 - EXAMINATION / ACCEPTANCE

A. Provide Test results as in specification 16700.

B. Provide AS Built drawings as in specification 16700.

C. Walk thru with UC representative Cable Quantity on all used routes and validate fill ratio on cable or Basket Tray.

D. Walk thru with UC representative Cable Quantity on all used routes and validate fill ratio on horizontal wire manager, vertical wire manager and ladder rack.

E. Following walk thru’s IT Facilities to create punch list of items that are unacceptable or unfinished. Vendor shall complete all punch list items prior to final University acceptance.

END OF SECTION 16770
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Installation, testing and provisioning of twisted pair, horizontal cabling.

B. Related Documents:
   1. Section 16700 – Common Work Results for Communications applies to this Section.
   2. Section 16705 – Grounding and Bonding for Communications Systems
   3. Section 16710 – Hangers and Supports for Communications Systems
   4. Section 16740 – Identification for Communications Systems
   5. Section 16760 – Communications Cabinets, Racks, Frames and Enclosures
   6. Section 16765 – Communications Termination Blocks and Patch Panels
   7. Section 16770 – Communications Cable Management

1.2 TYPICAL WORK AREA OUTLET

A. A Typical Work Area Outlet or (Drop) shall consist of three (3) (White end to end) Cat 6e 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.

C. A typical Wireless access point shall consist of two (2) (Purple end to end) Cat 6A Data Cables and one (White end to end) Cat 6e Data Cable.

1.3 SUBMITTALS

A. Conform with the requirements of Section 01330 - Shop Drawings, Product Data and Samples and 16700 - Common Work Results for Communications.

B. Provide Cable Inventory, Cable and room numbers where cables are to be installed in excel format.

C. As-Built, Cable placement represented by cable numbers indicating where they are installed in CAD format.

D. Third party verification of installation is required to validate proper cable identification.

PART 2 - PRODUCTS

2.1 MODULAR JACK COMPONENTS, GENERAL

1. Modular Jack CAT6A
   a. Panduit Mini-Com CL6X88TGVL

2. Colored Icons as needed per UC service designation
   a. Panduit PAN_CID(XX)
2.2 COPPER CABLELING, 6A AND CATEGORY 6 SHIELDED

A. High Speed Category Cabling, Non-Plenum
   a. Non-Plenum cable is not permitted and Not to be used.

B. High Speed, TIA Category 6A Cabling, Plenum Rated
   a. General Cable GenSpeed 6A Part No. 7141877 Purple

C. High Speed, TIA Category 6 Cabling, Plenum Rated, Shielded (Clinical Applications)
   a. General Cable GenSpeed 6 Part No. 7131792

2.3 TELECOMMUNICATIONS OUTLETS

A. Modular Furniture Surface mount Box
   a. Panduit CBXC4-BL-A Where BL = Black

B. Modular Surface Mount Box Attachment System
   a. Mini-Com CBM-X

C. Modular Surface Mount Box Blank Insert
   a. Panduit CMB(BL)

D. Faceplate
   a. Panduit - Mini-Com Stainless Steel Faceplates (CFP {2,4,6}SY / CFP{4,8,10}S-2GY

E. Faceplate Blank insert
   a. Panduit CMB(WH)

F. SL Wall Telephone Outlet
   a. Leviton 40223-S (where specified)

G. Hole wall plate,
   a. Leviton 84004-40 Stainless
   b. Leviton 80720 White where requested

H. Black loom
   a. Panduit loom CLT100F/CLT150F (choose size appropriate for cable installation quantity)
   b. Thomas & Betts black liquid tight EFC150

I. Duplex In-Line Jack frame, one to four jacks (Only where required, NOT standard installation)
   a. Panduit Mini-Com 106 Duplex Module Frame

J. Surface Raceway Receptacles (Only where required, NOT standard installation)
   a. Panduit Mini-Com GFCI Decora Module Frames

PART 3 - PREPARATION

A. Run Lengths:
   1. 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 closet.
   2. Mockup maximum cable length distances prior to proceeding with cable installation.
   3. Verify that no mechanical, electrical or other systems and piping systems, (e.g. water sources) interrupt the cable run.
   4. 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.

i. Locate proposed cable pathway drawing for the upcoming cable run.

ii. Contractor to install One (1) typical copper work area outlet complete with jacks at both ends. Use the proposed pathway and cabling to the furthest location from the TR.

iii. Install a cable simulating the cable length of the Plug Pack configuration.

iv. The cabling contractor is to perform testing of these cables patched together to determine the true length of this mockup.

v. Test Results are to be inspected and reviewed by the University’s Representative prior to proceeding with the rest of the installation.

vi. 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.

B. Coordinate UC inspector submittal confirmation when storing materials.

PART 4 - Installation

4.1 MODULAR JACK COMPONENTS

A. Category 6 / 6A Data Jacks Performance Requirements
   a. Follow manufacture’s Installation procedures.

4.2 MODULAR JACK ICON
   a. Can be clearly identified with UC Specified colored icons
   b. Manufacturer to offer the following colors:
      (a) Blue
      (b) Black
      (c) White
      (d) Gray
      (e) Green
      (f) Violet
      (g) Orange
      (h) Red

4.3 TELECOMMUNICATIONS OUTLETS

A. Modular Furniture Surface Mount Box, One to Four Jacks
   a. Surface mount box magnetically attached to furniture
   b. Removing knockouts in the base of the furniture shall be avoided.

B. Telecommunications Outlets, New, Copper Jacks, Wall Mount, Flush Mount
   1. Assembly. complete outlet assembly, including but not limited to:
      a. Faceplate with manufacturer's standard jack openings
      b. Blank connector modules at faceplate openings not filled with connector modules.
   2. Faceplate.
      a. Features:
         i. Single gang
         ii. Openings for the required number of cables
         iii. Provide flat stainless steel.
b. **Features:**
   i. Double gang
   ii. Openings for the required number of cables
   iii. Provide flat stainless steel

C. **In-Line Surface Raceway Receptacles**
   a. Supports jacks in a duplex electrical opening (NEMA 106 format).

D. **Duplex Jack frame, one to four jacks**
   a. Supports jacks in a duplex electrical opening (NEMA 106 format).

E. **Voice Telephone Station Plates and Jacks (special provision)**
   a. Wall Mounted analog Telephone

F. **Wall mounted IP Telephone Station**
   a. Single outlet wall plate w/ 8P8C data Jack

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**PART 5 - EXECUTION**

5.1 **COPPER CABBING DATA/VOICE/DISTRIBUTION**

1. Maintain the following clearances from EMI sources. (Per BICSI Standards)
   a. Electrical cable - 6 in.
   b. Fluorescent Lights - 12 in.
   c. Transformers - 48 in.

2. Monitor cable length limitations

3. All cable installations shall be continuous, unspliced runs

4. All wiring above ceilings shall be installed in cable tray or cable hangers.

5. Cable in accessible ceilings shall be supported 5’ on center (min) attached to building structure.

6. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket.

7. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.

8. Limit cable bends to a minimum radius of 4 times cable diameter except where otherwise noted herein.

9. Refrain from exceeding fill ratio on horizontal cabling installations

10. Service loop at ALL TERMINATIONS
    a. 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.

11. Service loop at work area outlet
    a. Flush mount Work Area Outlet, Ten Foot Service Loop shall be provided
    b. Modular Furniture System Feed Ten Foot Service loop in ceiling
    c. Mount WAP & connect (AP wireless access point, 2 CAT 6A cables each, one cat 6
    d. WAP (AP wireless access point, etc.,) Provide a (10’) Ten Foot Slack Loop
    e. Do not install outlet boxes for wireless AP’s (access points unless requested by the University)
    f. Security / Camera Locations Provide a (10’) Ten Foot Slack Loop

5.2 **TELECOMMUNICATIONS OUTLETS**

A. **Modular Furniture Surface Mount Box, One to Four Jacks**
   a. Use loom or protective covering from wall to modular furniture
   b. Use cover plate with access opening to cover single gang outlet
   c. Surface mount box magnetically attached to furniture
d. Removing knockouts in the base of the furniture shall be avoided.

e. Use Mini-Com CBX Series Surface Mount Box with CBM-X Magnets

f. Use outlet blank to fill in locations where cables are not installed

g. Panduit CBXC4-BL-A Where BL = Black

h. Label

B. Flush Mount outlet

a. Terminate, mount complete

b. TEST

c. Label

C. Surface Mount Outlet

a. Terminate, mount complete

b. TEST

c. Label

5.3 MODULAR JACK COMPONENTS, GENERAL

1. Termination of wiring at the station outlet:

a. All data and voice station cable shall be terminated at the individual receptacle modules in accordance with ANSI/TIA-568-C, assignment T568B.

b. Termination of wiring at existing station outlets:
   i. Install in data inserts in place of existing blank insert in existing faceplate.
   ii. Install new labels

2. Termination shall not untwist more than 1/2 inch of cable maximum from the manufactured condition.

5.4 MODULAR JACK ICON

a. Provide colored ICON for each data jack for ceiling devices.

b. Every ceiling data jack shall have a designation of gray

5.5 EXAMINATION / ACCEPTANCE

A. Provide as built drawing and desktop inventory ( cable / room ) spreadsheet

B. Provide cable test results

C. Complete walk thru with IT Facilities representative

D. Complete punch lists as necessary

E. Provide cable test results following furniture installation

F. Provide cable test results for cables in furniture

G. Provide room location of all cables

H. Provide laminated as built for each closet

I. Certification

   Warranty shall be provided from the manufacturer as provided by Panduit Certification Plus

END OF SECTION 16790
SECTION 16960
ELECTRICAL EQUIPMENT ACCEPTANCE TESTING

PART I - GENERAL

1.01 DESCRIPTION

A. The work required under this section of the specifications consists of the start-up testing and inspection of the electrical equipment designated within. All labor and testing equipment which is required shall be provided under this section of the specifications.

1.02 GENERAL

A. Perform the tests as outlined below to insure system acceptance and shall engage the services of approved testing organizations to provide start-up testing and inspection of the electrical equipment as specified in this section. The testing organizations may be an independent division of the manufacturer of the assembled products being tested. If an outside testing organization is approved, a representative of the manufacturer shall be under contract by the testing company. The representative shall be present during all testing to insure that the testing is performed properly and that any deficiencies discovered are promptly corrected.

B. The testing organization shall be a full service company that employs factory trained test engineers capable of trouble shooting as well as identifying equipment problems. All work outlined shall be performed under the full time on-site supervision of a graduate engineer with a minimum of five years of field-testing experience. The test, plan, procedures, and report shall be reviewed and approved by one of the testing company's electrical engineers. Upon request, the testing company shall submit proof of its qualifications.

C. The testing organization shall provide the equipment and technical personnel to perform such tests and inspections. Furnish any personnel necessary to assist in the testing and inspection.

D. When the tests and inspections have been completed, a label shall be attached to all devices tested. The label shall provide the name of the testing company, the date the tests were completed, and the initials of the engineer who performed the tests.

E. The tests shall insure that the equipment is operational and functioning within industry standards and manufacturer's tolerances. Forward all test reports to the University's Representative at least two weeks prior to the project final inspection for review. Reports shall be bound as required by Division 1 of this specification.

1.03 QUALITY ASSURANCE

A. The testing and inspection shall comply with all applicable sections of the following codes and standards:

1. American National Standards Institute – ANSI
3. Association of Edison Illuminating Companies – AEIC
4. Institute of Electrical and Electronics Engineers – IEEE
5. Insulated Power Cable Engineers Association – IPCEA
7. California Electrical Code – CEC
8. National Electrical Manufacturers Association – NEMA
10. State and Local Codes and Ordinances

B. The inspection and testing shall comply with the project plans and specifications as well as with the manufacturer’s drawings, instruction manuals, and other applicable data for the apparatus tested.

1.04 DIVISION OF RESPONSIBILITY

A. Perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. Supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

C. Notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. Supply a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.

E. Notify the University’s Representative prior to commencement of any testing.

F. Any system, material or installation which is found defective on the basis of acceptance tests shall be reported to the University’s Representative.

G. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.

1.05 SAFETY AND PRECAUTIONS

A. Safety practices shall comply with applicable state and local safety orders as well as with the Occupational Safety and Health Act of 1970 (OSHA). Compliance with the Accident Prevention Manual for Industrial Operations of the National Safety Council shall be observed.

B. Tests shall only be performed on apparatus which is de-energized. The testing company’s lead test engineer for the project shall be a designated safety representative and shall supervise testing observations and safety requirements. Work shall not proceed until the safety representative has determined that it is safe to do so.

C. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose. Warning signs and protective barriers shall be provided as necessary to conduct the tests safely. Follow OSHA lockout/tagout standards.
1.06 REPORTS

A. The test report shall include the following sections:

1. Scope of testing.
2. Equipment tested.
3. Description of test.
4. Test results.
5. Conclusions and recommendations.
6. Appendix, including test forms.

B. Each piece of equipment shall be recorded on a data sheet listing the condition of the equipment as found and as left. Included shall be recommendations for any necessary repair or replacement parts. The data sheets shall indicate the name of the engineer who tested the equipment and the date of the test completion.

C. Record copies of the completed test report shall be submitted no more than 30 days after completion of the testing and inspection.

1.07 TEST EQUIPMENT

A. All test equipment shall be in good mechanical and electrical condition. All field instruments shall have been calibrated within six months of the testing date, and dated calibration labels shall be visible on the testing equipment. Submit calibration certification in the final report.

PART II - PRODUCTS

2.01 MATERIALS

A. All materials are specified under other sections of this specification. All testing equipment required shall be provided under this section of the specifications.

PART III - EXECUTION

3.01 EQUIPMENT TO BE TESTED

A. The following equipment shall be tested in accordance with the scopes of work which follow. The party responsible is identified in accordance with the following key: C = Contractor/Installer; M = Manufacturer; T = Testing Agency.

1. Molded Case Circuit Breakers – C
2. Fire Alarm System – M
3. Grounding System – C
4. Cables, Low Voltage, 600 Volts Maximum – C
5. Low Voltage Power Circuit Breakers and Insulated Case Circuit Breakers – T
6. Lighting Control System – C

3.02 MOLDED CASE CIRCUIT BREAKERS

A. Visual and Mechanical Inspection:
   1. Inspect cover and case, and check for broken or loose terminals.
   2. Operate breaker to check operation.
   3. Verify proper reporting of the events on the project equipment monitoring system.

B. Electrical Tests (400 ampere frame and larger):
   1. Insulation Resistance Test: Megger main poles of breaker pole-to-pole, from each pole to ground, and across the open contacts of each pole.
   2. Contact Resistance Test: Ductor across main pole contacts with breaker closed and latched to check for good, low resistance contact.
   3. Test overcurrent trip device and calibrate. Where primary injection testing is specified, test each pole of the breaker individually. Data shall be compared with manufacturer’s published data.
      a. All trip units shall be tested by primary injection.
      b. Static overcurrent trip devices shall be tested per manufacturer’s instructions.
      c. Test for minimum pick-up current.
      d. Apply 300% of pick-up current and measure time necessary to trip breaker (long time delay).
      e. Where short time delay characteristics are provided, test short time pick-up and delay.
      f. Test instantaneous trip by passing current sufficiently high to trip breaker instantaneously.
      g. Where ground fault protection is provided, test ground fault pick-up and delay.
      h. Check reset characteristics of trip unit.
   4. Electrically test any auxiliary devices such as shunt trips, undervoltage trips, alarm switches, and auxiliary switches.

3.03 GROUNDING SYSTEM

A. Visual and Mechanical Inspection:
   1. Inspect wiring system outlet and junction boxes for proper grounding. Green grounding conductor shall be connected to outlet and junction boxes. Inspect a minimum of 5% of project boxes.
2. Verify connections of grounds for the secondary of separately derived grounding systems, i.e. at dry type transformers. Note type of connection, i.e. mechanical or exothermic.

3. Verify proper connection to all components of building service entrance grounding system. Note all system components which are interconnected and type of connection either mechanical or exothermic. Note depth of driven ground rods.

B. Electrical Tests (Small Systems):

1. Perform ground-impedance measurements utilizing the fall-of-potential method per ANSI/IEEE Standard 81 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System". Instrumentation utilized shall be specifically designed for ground impedance testing. Provide sufficient spacing so that plotted curves flatten in the 62% area of the distance between the item under test and the current electrode.

C. Equipment Grounds:

1. Utilize two-point method of IEEE Std. 81. Measure between equipment ground being tested and known low-impedance grounding electrode or system.

D. Electrical Tests (Large Systems):

1. When sufficient spacing of electrodes described above is impractical, perform ground-impedance measurements utilizing either the intersecting curves method or the slope method. (Ref. Nos. 40 and 41 in IEEE Std. 81.)

E. Test Values:

1. The main ground electrode system impedance-to-ground should be no greater than five (5) ohms. Equipment grounds, depending on size and length of grounding conductor, should be only fractionally higher than system ground.

3.04 CABLES - LOW-VOLTAGE - 600V MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect cables for physical damage and proper connection in accordance with single-line diagram.

2. Test cable mechanical connections to manufacturer's recommended values using a calibrated torque wrench.

3. Check cable color-coding with applicable specifications and National Electrical Code standards.

B. Electrical Tests:

1. Perform insulation-resistance test on each feeder on the riser diagram with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.

2. Perform continuity test to insure proper cable connection.
C. Test Values:

1. Evaluate results by comparison with cables of same length and type. Investigate any values less than 50 megohms.

Provide a test report for each feeder which indicates the manufacturer's target values and actual test reading. Report shall indicated pass/fail for each feeder. Submit report to University's Representative for approval. Include test report in project maintenance manual.

D. Feeder Cables:

1. 600-volt feeder cables in the building and secondary service cables to the building shall be tested using a megohmeter, to measure the insulation resistance of each conductor in the circuit.

2. Disconnect all equipment switches, relays, buswork, transformers, etc.) from the cable being tested.

3. Tests to be performed in a dry area.

4. Clean and dry cable ends with a cloth moistened with a suitable solvent.

E. Cable Values: Cable values shall be established and provided by the cable manufacturer. Provide target value insulation resistance (IR) in megohms, based on 1000 ft. at 60°F.

F. Temperature Correction Factor: For temperatures above or below 60°F, a correction factor may have to be applied to determine the true IR value. However, if the measured IR of the system is equal to or greater than the calculated value, a correction factor is not needed.

G. Correct insulation deficiencies which show and insulation resistance of less than one megohm.

H. Test conductors with power off and impress a voltage of not less than 500 volts D.C.

I. Perform continuity tests on all conductors.

3.05 LOW VOLTAGE POWER CIRCUIT BREAKERS AND INSULATED CASE CIRCUIT BREAKERS

A. Visual and Mechanical Inspection:

1. Remove each draw-out type circuit breaker.

2. Inspect arc chutes of power circuit breakers.

3. Inspect circuit breaker for defects or damage.

4. Inspect and check contacts. Check alignment, over-travel, and pressure. Adjust if necessary.

5. Inspect finger clusters on line and load stabs of draw-out circuit breakers.

6. Check for proper mechanical operation. Lubricate where necessary.
7. Check auxiliary devices for proper operation.
8. Check breaker racking device (if applicable) for alignment and friction-free operation. Lubricate if necessary.
9. Verify proper reporting of the events on the project equipment monitoring system.

B. Electrical Tests:

1. Insulation Resistance Test: Megger main poles of breaker pole-to-pole, from each pole to ground, and across the open contacts of each pole.
2. Contact Resistance Test: Ductor across main pole contacts with breaker closed and latched to check for good, low resistance contact.
3. Test overcurrent trip device by primary injection and calibrate to settings provided. Static overcurrent trip devices shall be tested per the manufacturer's instructions. Test each pole of the breaker individually. Data shall be compared with manufacturer's published data.
   a. Test for minimum pick-up current.
   b. Apply 300% of pick-up current and measure time necessary to trip breaker (long time delay).
   c. Where short time delay characteristics are provided, test short time pick-up and delay.
   d. Test instantaneous trip by passing current sufficiently high to trip breaker instantaneously.
   e. Where ground fault protection is provided, test ground fault pick-up and delay.
   f. Check reset characteristic of trip unit.
4. Electrically test any auxiliary devices such as shunt trips, undervoltage trips, alarm contacts, and auxiliary contacts.

3.06 LIGHTING CONTROL SYSTEM

A. Visual and Mechanical Inspection:

1. Inspect each device for physical damage.
2. Check for proper labeling of conductors.
3. Inspect all system lamps and LED’s for proper operation. Replace all non-operational equipment.
4. Check all cabinet doors, latches, and hinges for proper operation. Adjust, lubricate, and repair as required.

B. Electrical Tests:
1. Verify the absence of unwanted voltages between circuit conductors and ground that would constitute a hazard or prevent proper system operation.

2. Meggar test all conductors (other than those intentionally grounded) for isolation from ground.

3. Test all conductors (other than those intentionally connected together) for conductor-to-conductor isolation using an insulation testing device.

4. The control unit shall be tested to verify it is in the proper operating condition as detailed in the manufacturer's manual.

5. Each control circuit shall be tested to confirm proper operation of the circuit. Monitor the system with all building equipment energized, such as variable speed controllers, to verify the absence of control inhibiting electrical noise.

END OF SECTION 16960