

**SPECIFICATIONS
FOR
SOD - TIER NETWORK INSTALLATION**

**UNIVERSITY OF CALIFORNIA
LOS ANGELES CAMPUS
LOS ANGELES, CALIFORNIA**

JUNE 2010

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SECTION 01011
GENERAL PROVISIONS

1. GENERAL

1.1 NOT USED

1.2 APPARATUS AND EQUIPMENT LOCATIONS

- A. Locations of apparatus and equipment indicated on the Drawings are approximate only, and are subject to change to suit operational service as approved by University's Representative.
- B. Furnish and install apparatus and equipment in a manner and in locations which keep openings and passageways clear. Make changes in locations of equipment and materials which may be necessary to accomplish these purposes as approved by University's Representative.

1.3 ANCHORS AND FASTENERS

- A. Submit manufacturer's literature and calculations for anchoring and fastening devices to University's Representative for approval.
- B. For concrete, except as listed below, use two-piece expansion anchors or drilled-in fasteners as shown. Concrete nails are not permitted.
- C. The use of low velocity powder-activated tools is permitted only for the conditions described below. The use of medium and high velocity powder-activated fasteners as defined by ANSI A10.3 is prohibited.
 - 1. Permitted Uses of Low Velocity Powder-Actuated Fasteners:
 - a. Anchoring metal track for interior non-load bearing walls. Note: Door frames shall be fastened with two-piece expansion anchors.
 - b. Fastening of furring strips to concrete walls.
 - c. Temporary fastening and concrete forming.
 - d. Installation of incidental straps and wires used to suspend the following:
 - 1) Metal duct work of 25 pounds per linear foot or less;
 - 2) Piping of 1" diameter or less;
 - 3) Electrical conduit of 2" diameter or less.
 - e. Fastening of plaster accessories, flashing and similar items with negligible loading.
 - 2. Requirements for Low Velocity Powder Actuated Fasteners.
 - a. Minimum shank: .143 inch diameter; minimum penetration: 1.25 inches for 3000 psi concrete; minimum rated tensile strength: 310 lbs; minimum rated shear strength: 420 lbs. Contractor shall submit calculations to substantiate selection.
 - b. Weight suspended from each connection shall not exceed 200 lbs.
 - c. Where designated by University's Representative, anchors, fasteners and ties installed utilizing low velocity powder-actuated tools will be tested by an independent testing laboratory to resist two times the design load. Any such anchor, fastener or tie which fails such a test shall be replaced by Contractor at no cost to University.
 - 3. Procedures for use of low velocity powder actuated tools:
 - a. The use of low velocity powder actuated tools shall comply with Federal OSHA safety requirements and California Code of Regulations Title 24, including the requirement that the operator of the tool be trained and certified. Submit certification.
 - b. Submittal of manufacturer's literature and calculations for anchoring and fastening devices shall include load calculations and minimum spacing for fasteners for each specific use. Design for a factor of safety of two times allowable load. Calculations shall be signed by Contractor's structural engineer. Structural engineer shall be registered in California.
 - c. Conform to SMACNA low velocity shotpin installation requirements.

1.4 SUPERINTENDENT

- A. In addition to requirements specified in Article 3 of the General Conditions, submit Superintendent's qualifications showing a minimum of 10 years experience in coordinating projects of similar scope, size and complexity as this Project within the United States, including the construction, provision and installation of low voltage voice/data systems and infrastructure.

1.5 SURROUNDING SITE CONDITION SURVEY

- A. Prior to commencing the Work, Contractor and University's Representative shall tour the Project site together to examine and record damage to existing adjacent buildings and improvements. This record shall serve as a basis for determination of subsequent damage due to Contractor's operations and shall be signed by all parties making the tour. Any cracks, sags, or damage to the adjacent buildings and improvements not noted in the original survey, but subsequently discovered, shall be reported to University's Representative.

1.6 REPAIR OF EXISTING WORK

- A. Whenever any cutting, removal, or alterations of existing work is required to form connections with new work or otherwise meet the requirements of the Contract Documents, perform such work so as

not to damage the work that will remain in place. Perform patching and repairs occasioned thereby using materials, construction details, and finishes matching those of the existing work as closely as possible and to the approval of University's Representative.

1.7 **NOT USED**

1.8 **NOT USED**

END OF SECTION

SECTION 01012
INFORMATION & PROCEDURE INSTRUCTIONS (RFI)

1. GENERAL

1.1 DESCRIPTION

- A. This Section contains the procedures to be followed by Contractor upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or upon having any question concerning interpretation.
- B. Procedures:
1. Notification by Contractor:
 - a. Submit all requests for clarification or additional information in writing to University's Representative using the Request for Information (RFI) form provided by University's Representative or a similar form approved by University's Representative.
 - b. Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix as necessary for each resubmission. For example, the first RFI would be "001." The second RFI would be "002." The first resubmittal of RFI "002" would be "002a."
 - c. Limit each RFI to one subject.
 - d. Submit an RFI if one of the following conditions occur:
 - 1) Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.
 - 2) Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
 - 3) Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.
 - e. Contractor shall not:
 - 1) Submit an RFI as a request for substitution.
 - 2) Submit an RFI as a submittal.
 - 3) Submit an RFI under the pretense of a Contract Documents discrepancy or omission without thorough review of the Documents.
 - 4) Submit an RFI in a manner that suggests that specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.
 - 5) Submit an RFI in an untimely manner without proper coordination and scheduling of Work of related trades.If Contractor submits an RFI contrary to the above, Contractor shall pay the cost of all review, which cost shall be deducted from the Contract Sum.
 - f. Contractor shall submit request for information or clarification immediately upon discovery. Contractor shall submit RFIs within a time frame so as not to delay the Contract Schedule while allowing the full response time described below.
 2. Response Time:
 - a. University's Representative, whose decision will be final and conclusive, shall resolve such questions and issue instructions to Contractor within a reasonable time frame. In most cases, RFIs will receive a response within 14 days. If in the opinion of University's Representative more than 14 days is required to prepare a response to an RFI, Contractor will be notified in writing.
 - b. Should Contractor proceed with the Work affected before receipt of a response from University's Representative, within the response time described above, any portion of the Work which is not done in accordance with University's Representative's interpretations, clarifications, instructions, or decisions is subject to removal or replacement and Contractor shall be responsible for all resultant losses.
 - c. Failure to Agree: In the event of failure to agree as to the scope of the Contract requirements, Contractor shall follow procedures set forth in Article 4 of the General Conditions.

END OF SECTION

SECTION 01014
CONTRACTOR'S USE OF THE PROJECT SITE

1. GENERAL

1.1 STORAGE

- A. Contractor's use of the Project site for the Work and storage is restricted to the areas designated on the Drawings or as approved by University's Representative. Refer also to Section 01600, MATERIAL & EQUIPMENT.

1.2 USE OF PUBLIC THOROUGHFARES AND UNIVERSITY ROADS

- A. Contractor shall make its own investigation of the condition of available public thoroughfares and University roads, and of the clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the Project site.
- B. Where materials are transported in the prosecution of the Work, do not load vehicles beyond the capacity recommended by manufacturer of the vehicles or prescribed by any applicable state or local law or regulation.
- C. Use only established roads on the campus; provided, however, that such temporary haul roads as may be required in the work shall be constructed and maintained by Contractor, subject to the approval of University's Representative.
- D. Provide protection against damage whenever it is necessary to cross existing sidewalks, curbs, and gutters in entering upon the University roads. Repair and make good at the expense of Contractor all damages thereto, including damage to existing utilities and paving, arising from the operations under the Contract.
- E. Truck staging is not allowed on campus or on any residential street surrounding the campus.

1.3 WATCHMAN'S SERVICES

- A. During all hours that Work is not being prosecuted, furnish such watchman's services as Contractor may consider necessary to safeguard materials and equipment in storage on the Project site, including Work in place or in process of fabrication, against theft, acts of malicious mischief, vandalism, and other losses or damages.
- B. University will not be liable for any loss or damage.

1.4 RUBBER-TIRED EQUIPMENT

- A. Where carts, hand trucks, wheelbarrows, and similar wheeled conveyances are used on or in any portions of any structure, equip with pneumatic tires.

1.5 SITE DECORUM

- A. Contractor shall control the conduct of its employees so as to prevent unwanted interaction initiated by Contractor's employees with UCLA students, UCLA staff, or other individuals (except those associated with the Project), adjacent to the Project site. Unwanted interaction by Contractor employees would include whistling at or initiating conversations with passersby. In the event that any Contractor employee initiates such unwanted interaction, or utilizes profanity, Contractor shall, either upon request of University's Representative or on its own initiative, replace said employee with another of equivalent technical skill, at no additional cost to University. No radios, other than two-way communication type, will be allowed on the Project site. No smoking is allowed in any University Building.

1.6 PARKING

- A. No vehicle shall be allowed to park on the UCLA campus without displaying the appropriate permit(s), as follows:
1. For Parking in Designated Parking Space (i.e. Parking Structure, Open Lot) and For Construction Parking at the Project Site in Non-Fenced Areas on Hardscape: A valid parking permit is required. Permits may be purchased by the day, week, month or quarter on an as-available basis. Permits may be purchased on a daily basis from any Parking Service Kiosk. For longer term parking, permits must be purchased directly from Parking Service located at 555 Westwood Plaza (Parking Structure Number 8). Permits are valid in the area of assignment only. Violators are subject to citation.
 2. Mobility:
 - a. Contractors and Subcontractors who are currently engaged in work on more than one project on the Campus and need mobility between project sites, or who need in-and-out privileges during the day from parking structures/lots, shall be required to make those arrangements at the time permits are obtained. A valid permit and contractor placard must be displayed. No mobility will be allowed in Dickson Court (Portola Plaza) or at meters, handicap stalls or stalls otherwise reserved, or in designated fire lanes. Violators will be cited.
 - b. Card keys will be issued ONLY to Contractors and Subcontractors who have two or more construction projects in process on the UCLA Campus.
- B. PARKING ARRANGEMENTS FOR THIS PROJECT: Contractor shall arrange and pay for all parking for itself, its subcontractors, and its employees.

1.7 TEMPORARY STAIRS, SCAFFOLD AND RUNWAYS

- A. Provide all scaffolds, stairs, hoist plant, runways, platforms, and similar temporary construction as may be necessary for the performance of the Contract. Such facilities shall be of the type and arrangement as required for their specific use, substantially constructed throughout and strongly supported, well secured and complying with all applicable rules and regulations of the Industrial Accident Commission of the State of California and all applicable laws and ordinances. Refer to Section 01060, REGULATORY REQUIREMENTS.
- B. Arrange for construction equipment access to areas which may be partly blocked by existing obstructions.

1.8 TEMPORARY HOISTS

- A. Provide temporary hoist as required by job conditions for the installation of materials and equipment. Install and operate in accordance with all safety regulations of authorities having jurisdiction. Refer to Section 01060, REGULATORY REQUIREMENTS.

1.9 TEMPORARY SHORING AND BRACING

- A. Provide temporary shoring and bracing as required for execution of the Work. Refer to Section 01500, CONSTRUCTION FACILITIES & TEMPORARY CONTROLS. All shoring and bracing shall comply with safety regulations of authorities having jurisdiction (refer to Section 01060, REGULATORY REQUIREMENTS).

1.10 TEMPORARY BARRICADES

- A. Provide temporary barricades as necessary and at entries to all new hub room spaces to prevent unauthorized access. Maintain barricades in a clean and neat condition until no longer required and removal is approved or requested.
- B. When Work involves modification to an existing egress corridor, Contractor shall provide temporary barricades as necessary, constructed in a manner that maintains the fire resistive integrity of the affected corridor(s). Construction and placement of the barricades shall be approved by University's Representative.

1.11 REMOVAL AND RECONDITIONING

- A. Temporary facilities, barricades, utilities and other construction of temporary nature shall be removed from the Project site as soon as the progress of the work will permit in the opinion of University's Representative; and the portions of the Project site and building occupied by same shall be reconditioned and restored to original condition. For temporary utilities, refer to Section 01510, TEMPORARY UTILITIES.
- B. Legally dispose of all debris resulting from removal and reconditioning operations.

1.12 CONTROL OF CONSTRUCTION WATER

- A. Provide impermeable floor coverings and suitable dams to prevent damage by water used for the Work. Immediately clean up and remove all surplus water and water spilled in non-working areas. Do not allow water to overflow gutters or flood streets.

1.13 WORK HOURS

- A. Unless otherwise approved in advance by University's Representative, the following construction activities shall be accomplished only between the hours of 5:00 p.m. and 6:30 a.m. Mondays through Fridays, any hours on weekends:
 - 1. All demolition activities including but not limited to walls, flooring, ceilings, electrical, mechanical and plumbing.
 - 2. Hazardous materials abatement.
 - 3. Drilling into concrete deck or walls for the installation of anchors, supports, etc.
 - 4. Coring/saw-cutting of floors and walls.
 - 5. Welding.
 - 6. Installation of horizontal conduit/cable tray, including drilling for support brackets, seismic braces and anchors.
 - 7. Rough-in of horizontal communications cable runs, including creating openings in existing walls at new cabling faceplate locations.
- B. Unless otherwise approved in advance by University's Representative, all remaining Work of this Project shall be accomplished only during the following hours:
 - Mondays through Fridays 7:00 a.m. to 6:00 p.m.
 - Saturdays 8:00 a.m. to 6:00 p.m.
 - No work shall be performed on Sundays or University holidays.

1.14 CONSTRUCTION SIGNAGE

- A. All signage shall be as approved by University's Representative.
- B. University-Furnished Warning Signs: Whenever required by University's Representative, post University-furnished warning signs in locations as directed.
- C. Advertising Signage: The use of Contractor/subcontractor advertising signage is prohibited.
- D. Not Used.

1.15 HISTORICAL, ARCHEOLOGICAL AND PALEONTOLOGICAL RESOURCES

- A. In order to preserve and protect potentially historic, archeological or paleontological resources that could be encountered on a construction site, University's Representative will give the information

handout, "UCLA Needs Your Help to Protect the Past" to Contractor at the Pre-Construction Meeting referenced in Section 01200, PROJECT MEETINGS. Contractor shall ensure that all appropriate Subcontractors receive said handout, that they comply with all applicable requirements during excavation and construction, and that they understand that the unauthorized collection of historic, archeological or paleontological resources is prohibited by law. Contractor's responsibility includes (1) distributing the information handout to all construction personnel working on a site prior to commencing any earthmoving activities; (2) immediately halting all work in all areas where any potentially historic, archeological or paleontological remains (as identified in the handout) are uncovered; and (3) immediately notifying University's Representative if such materials are found. Contractor shall not resume work in the affected areas until authorized by University's Representative.

1.16 NOT USED

1.17 NOT USED

1.18 NOT USED

1.19 ACCESS

- A. Work in the low-rise clinic section of the building is restricted. All work in clinic areas shall be coordinated with University's Representative at least 48 hours in advance of the start of work.
- B. Access to all occupied work spaces shall be coordinated with University's Representative in advance based on Contractor's 2-3 Day and 2-3 Week Look Ahead Schedules (refer to Section 01310). Contractor's Superintendent shall be the single point of contact responsible for coordinating with University's Representative access to planned work areas. Superintendent shall verify that all work has been completed in the planned work area(s) via the development and provision of an "End of Shift" report detailing areas where work took place and the status of that work, and for verification that all work areas are clean and in the condition in which they were found prior to the start of work.
- D. When working in occupied spaces all furnishings will be covered to prevent dust and debris. Covers shall be removed at end of shift.
- E. Keys may be furnished to Contractor's Superintendent to allow independent access to specific work areas. In the event any keys are lost or misplaced, Contractor shall be responsible for the cost of rekeying all doors associated with the lost key(s).
- F. Provide "walk off" mats outside work areas.
- G. Floors in and around work areas shall be swept clean and damp mopped during both day and evening shift work to control dust.

END OF SECTION

SECTION 01019
WORK SEQUENCE

1. GENERAL

1.1 DESCRIPTION – NOT USED

1.2 SEQUENCES

- A. Hub Room Construction: Contractor shall begin the construction of the 7th floor hub room and work down through the Dentistry tower, top to bottom. Once the construction of the 7th floor hub room is complete, along with cable rough-in at that level, Contractor shall furnish and install at least one (1) fully configured telecom rack to include racks, patch panels, wire managers, cable ladders, etc. before beginning the installation of telecom equipment on any other floors. Upon review and approval of the fully configured rack, Contractor will be authorized to proceed with the build out of all other telecom racks and associated cables and equipment using the 7th floor rack as the standard throughout the Project.

END OF SECTION

SECTION 01041
PROJECT COORDINATION

1. GENERAL

1.1 DESCRIPTION

- A. Coordinate the Work and do not delegate responsibility for coordination to any Subcontractor.
- B. Anticipate the interrelationship of all Subcontractors and their relationship with the Work.
- C. Resolve differences or disputes between Subcontractors concerning coordination, interference, or extent of Work between sections of the Work.
- D. Coordinate the Work of Subcontractors so that portions of the Work are performed in a manner that minimizes interference with the progress of the Work.
- E. Do not obstruct spaces and installations that are required to be clear by Applicable Code Requirements. Refer to Section 01060, REGULATORY REQUIREMENTS.
- F. Do not cover any piping, wiring, ducts, or other installations until they have been inspected and approved, and required certificates of inspection issued.
- G. Remove and replace all Work which does not comply with the Contract Documents. Repair or replace any other Work or property damaged by these operations with no adjustment of Contract Sum.
- H. Coordinate all portions of the Work requiring careful coordination in order to fit in space available. Before commencing such portions of the Work, prepare supplementary Drawings for review by University's Representative.
- I. Refer to Section 01310, CONTRACT SCHEDULES, Paragraph 2.10.A, "Look Ahead Schedules."

END OF SECTION

SECTION 01043
JOB SITE ADMINISTRATION

1. GENERAL

1.1 CONTRACTOR'S CORRESPONDENCE

- A. Contractor's correspondence directed to University's Representative.
 - 1. Original and 2 copies to University's Representative.
 - 2. 1 copy to University's Project Manager.

1.2 UNIVERSITY'S REPRESENTATIVE'S CORRESPONDENCE

- A. University's Representative's correspondence directed to Contractor.
 - 1. Original and 2 copies to Contractor.
 - 2. 1 copy to University's Project Manager.

1.3 PROGRESS PAYMENTS

- A. In accordance to General Conditions, Article 9, summarize quantities and percentages of completion, agreed upon by Contractor and University's Representative, on the Cost Breakdown contained in the Application for Payment. Submit 3 copies to University's Representative.

1.4 CHANGES IN THE WORK

- A. Refer to General Conditions, Article 7.
- B. Request for Estimate (RFE) and Special Drawings:
 - 1. Changes in the Work will be initiated by University's Representative in the written form of a RFE and numbered in sequence using the "500" series.
 - 2. Special Drawings that are issued with RFE's will be numbered in sequence using the RFE number.
 - 3. Contractor shall price and return RFE's within 7 days after receipt.
- C. Field Orders: Field Orders, if necessary to preclude unnecessary delays/costs, will be initiated by University's Representative and numbered sequentially using the "300" series.
- D. Change Orders will be numbered in sequence 1, 2, 3, etc.
- E. Clarification Drawings: Clarification Drawings will be numbered in sequence using "1000" series.
- F. Cost Proposals for changes as follows: Original and 2 copies to University's Representative, and 3 copies to University's Project Manager. (Attach RFE and/or Field Order to each Cost Proposal.)
 - 1. Submit in accordance with the General Conditions.
- G. Cost Proposals shall show detailed breakdown of material, labor, etc., plus applicable percentages for Contractor Fee as specified in Article 7 of the General Conditions. (Sample format for submittal will be distributed at the Pre-Construction Meeting specified in Section 01200, PROJECT MEETINGS.)
- H. University's Representative will prepare and process Change Orders. Final distribution will be made by University's Project Manager after Change Orders are fully executed.

1.5 CERTIFIED PAYROLL RECORDS

- A. In addition to the requirements of the General Conditions, Contractor shall submit with each Application for Payment an accurate payroll record showing the name, address, social security number or classification, straight-time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyworker, apprentice, laborer, or other employee employed by it in connection with the Work for the period covered by the Application for Payment. The payroll record shall be certified. Failure to submit the certified payrolls with the Application for Payment will result in a delay in processing the progress payment until the certified payrolls are received.

1.6 CONTRACTOR'S DAILY REPORTS

- A. Contractor and each subcontractor on site shall completely fill out a Contractor's Daily Report, on forms provided by University's Representative (refer to Exhibits, bound herein), for each day worked. It is the responsibility of Contractor to submit all Daily Reports, including those of subcontractors, by 9:00 a.m. the following work day. Failure to submit Daily Reports in a timely manner may result in delayed progress payment(s).

END OF SECTION

SECTION 01060 REGULATORY REQUIREMENTS

1. GENERAL

1.1 DESCRIPTION

- A. The Work shall be performed in accordance with Applicable Code Requirements and applicable requirements of all other regulatory agencies, including the following:
1. California Code of Regulations (CCR), Title 8, Industrial Safety.
 2. CCR, Title 13, Hazardous Materials Transportation.
 3. CCR, Title 17, Radiation Safety.
 4. CCR, Title 19, Public Safety.
 5. CCR, Title 20, Public Utilities and Energy.
 6. CCR, Title 21, Public Works.
 7. CCR, Title 23, Underground Storage Tank Regulations.
 8. CCR, Title 24
 - a. Part 1, Building Standards Administrative Code.
 - b. Part 2, California Building Code (2006 IBC with 2007 California Amendments).
 - c. Part 3, California Electrical Code (2005 NEC with 2007 California Amendments).
 - d. Part 4, California Mechanical Code (2006 UMC with 2007 California Amendments).
 - e. Part 5, California Plumbing Code (2006 UPC with 2007 California Amendments).
 - f. Part 6, California Energy Code.
 - g. Part 7, California Elevator Safety Construction Code.
 - h. Part 8, California Historical Building Code.
 - i. Part 9, California Fire Code (2006 IFC with 2007 California Amendments).
 - j. Part 10, California Code for Building Conversion.
 - k. Part 12, California Referenced Standards Code.
 9. CCR, Title 25, Housing and Community Development.
 10. CCR, Title 26, Toxics.
 11. National Fire Protection Association (NFPA) :

NFPA Standards	Edition	
11	Low-, Medium- and High-Expansion Foam	2005
12	Carbon Dioxide Extinguishing Systems	2008
12A	Halon 1301 Fire Extinguishing Systems	2009
13	Installation of Sprinkler Systems	2007
13R	Sprinkler Systems for Residential Occupancies	2007
13D	Sprinkler Systems for One- and Two-Family Dwellings	2007
14	Installation of Standpipes and Hose Systems	2009
15	Water Spray Fixed Systems	2007
16	Installation of Foam-Water Sprinkler & Foam-Water Spray Systems	2007
17	Dry Chemical Extinguishing Systems	2009
17A	Wet Chemical Extinguishing Systems	2009
20	Installation of Stationary Pumps for Fire Protection	2007
22	Water Tanks for Private Fire Protection	2008
24	Installation of Private Fire Service Mains	2007
37	Stationary Combustion Engines and Gas Turbines	2006
45	Laboratories Using Chemicals	2004
54	National Fuel Gas Code	2009
58	Liquefied Petroleum Gas Code	2008
72	National Fire Alarm Code	2007
80	Fire Doors and Other Opening Protectives	2007
92A	Smoke-Control Systems	2009
99	Health Care Facilities	2005
101	Life Safety Code (for Laboratory Construction)	2009
110	Emergency and Stand-by Power Systems	2005
253	Test for Critical Radiant Flux of Floor Covering Systems	2006
- B. When the California Building Code does not specifically cover any subject relating to building design and construction, recognized fire prevention engineering practices shall be employed. The following may be used as authoritative guides when determining recognized fire prevention engineering practices:
1. The National Fire Codes.
 2. The Fire Protection Handbook.
- C. 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 or Field Order, as applicable.

- D. Representatives of the Los Angeles City Fire Department, Division of State Architect (DSA) and California Occupational Safety and Health Act (Cal/OSHA) have the right to inspect all Work and workplace conditions.

1.2 CONFLICTS

- A. If a conflict exists between referenced regulatory requirements or between referenced regulatory requirements and the Contract Documents, Contractor shall notify University's Representative and request that the conflict be resolved. The fact that the Contract Documents may establish higher or more costly requirements than the minimum Code or other regulatory requirements referenced above shall not constitute a "conflict."

END OF SECTION

SECTION 01090
ABBREVIATIONS, SYMBOLS & DEFINITIONS

1. GENERAL

1.1 ABBREVIATIONS

A. The following abbreviations of organizations may be used in the Contract Documents.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AAN	American Association of Nurserymen, Inc.
AASHTO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACPA	American Concrete Pipe Association
ADA	Americans with Disabilities Act
ADC	Air Diffusion Council
AFBMA	Anti-Friction Bearing Manufacturers Association
AFI	Air Filter Institute
AGA	American Gas Association
AGC	Associated General Contractors of America
AHERA	Asbestos Hazard Emergency Response Act
AI	The Asphalt Institute
AIA	American Institute of Architects
AIMA	Acoustical Insulating Material Association
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
AOAC	Association of Official Analytical Chemists
APA	American Plywood Association
API	American Petroleum Institute
AQMD	Air Quality Management District
ARI	Air-Conditioning and Refrigeration Institute
ASA	American Standards Association
ASAHCA	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers Association, Inc.
ASTM	American Society for Testing and Materials
AWCI	Association of Wall and Ceiling Industries
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society, Inc.
AWWA	American Water Works Association, Inc.
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BOCA	Building Officials and Code Administrators
CAC	California Administrative Code
Cal/OSHA	California Occupational Safety and Health Act
CARB	California Air Resources Board
CBM	Certified Ballast Manufacturers Association
CCR	California Code of Regulations
CDA	Copper Development Association, Inc.
CE	Corps of Engineers (U. S. Dept. of the Army)
CEC	California Energy Commission
CESO	California Elevator Safety Order
CGA	Compressed Gas Association
CLFMI	Chain Link Fabric Manufacturers Institute
CLPCA	California Lathing and Plastering Contractors Association, Inc.
CPSC	Consumer Product Safety Commission
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards of NBS (U.S. Dept. of Commerce)
CTI	Cooling Tower Institute
CTLA	Council of Tree and Landscape Appraisers

DHI	Door & Hardware Institute
DISS	Diameter Index Safety System
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories
FFDA	Federal Food and Drug Administration
FIA	Factory Insurance Association
FM	Factory Mutual Engineering Corp.
FS	Federal Specification
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America (formerly FGMA)
GFI	Ground Fault Interrupter
HEPA	High Efficiency Particulate Air
HI	Hydronics Institute
HMI	Hoists Manufacturers Institute
HMMA	Hollow Metal Manufacturers Association
HPMA	Hardwood Plywood Manufacturers Association
IBEW	International Brothers of Electrical Workers
IBR	Institute of Boiler and Radiator Manufacturers
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineering Association
IEEE	Institute of Electrical and Electronic Engineers
IEC	International Electric Code
IES	Illuminating Engineers Society
IGCC	Insulation Glass Certification Council
ISA	Instrument Society of America
LIA	Lead Industries Association
MFMA	Maple Flooring Manufacturers Association
MIA	Marble Institute of America
MIL	U.S. Government, Military Specification
MLSFA	Metal Lath/Steel Framing Association
MOC	Ministry of Communications General
MSHA	Mine Safety and Health Administration
MSS	Manufacturers Standardization Society of Valve and Fittings
NAA	National Arborist Association
NAAB	National Association of Air Balance
NAAMM	The National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBFU	National Board of Fire Underwriters
NBGQA	National Building Granite Quarries Association, Inc.
NBHA	National Builders' Hardware Association
NBS	National Bureau of Standards (U. S. Dept. of Commerce)
NCMA	National Concrete Masonry Association
NCPWB	National Certified Pipe Welding Bureau
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code by NFPA
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NESHAP	National Emissions Standard for Hazardous Air Pollutants
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NICET	National Institute for Certification in Engineering Technologies
NIOSH	National Institute of Occupational Safety and Health
NPA	National Particleboard Association
NRC	Noise Reduction Coefficient
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NUSIG	National Uniform Seismic Installation Guidelines
NWMA	National Woodwork Manufacturers Association, Inc.
NWWDA	National Wood Window and Door Association
OPL	Omega Point Laboratories
OSHDP	Office of Statewide Health Planning and Development
PCA	Portland Cement Association
PCB	Polychlorinated Biphenyl
PCI	Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors Association
PDI	Plumbing and Drainage Institute
PI	Perlite Institute

PS	Product Standard of NBS (U.S. Dept. of Commerce)
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service (Grading Rules)
SAE	Society of Automotive Engineers
SAS	Saudi Arabian Standard Organization
SBC	State Building Code
SCAQMD	South Coast Air Quality Management District
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal & Air Conditioning Contractors' National Assoc., Inc.
SPIB	Southern Pine Inspection Bureau (Grading Rules)
SSPC	Society for Protective Coatings
STC	Sound Transmission Coefficient
SWI	Sealant and Waterproofers Institute
TCA	Tile Council of America, Inc.
UBC	Uniform Building Code
UFAS	Uniform Federal Accessibility Standards
UHMW	Ultra-High Molecular Weight
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USDA	United States Department of Agriculture
USSG	United States Steel Gauge
WCLIB	West Coast Lumber Inspection Bureau (Grading Rules)
WH	Warnock Hersey
WIC	Woodwork Institute of California
WWPA	Western Wood Products Association (Grading Rules)

1.2

DEFINITIONS

- A. The following terms, when used on the Drawings or in the Specifications, shall have the following meanings:
1. ADEQUATE; CAREFUL; PROPER; SUFFICIENT; SUITABLE; SATISFACTORY: These terms refer to interpretation by University's Representative, and are subject to approval upon request.
 2. APPLICABLE CODES: "Codes listed in Section 01060, REGULATORY REQUIREMENTS."
 3. APPROVED: "As approved by University's Representative."
 4. AS DIRECTED: "As directed by University's Representative."
 5. AS REQUIRED: "As required by Applicable Code Requirements; by good building practice; by the conditions prevailing; by the Contract Documents; by University, or by University's Representative."
 6. AS SELECTED: "As selected by University's Representative."
 7. BY OTHERS: Work on the Project that is outside the scope of Work to be performed by Contractor under the Contract, but that will be performed by University, Separate Contractors, or other means.
 8. EQUAL: Of same quality, appearance, and utility to that specified, as determined by University's Representative. Contractor bears the burden of proof of equality.
 9. FURNISH: "Supply only, not install (unless required to be provided or installed elsewhere in the Contract Documents)."
 10. INCLUDE/INCLUDING: "Include/including, without limitation."
 11. INSTALL: "Install or apply only, not furnish (unless required to be provided or furnished elsewhere in the Contract Documents)".
 12. MANUFACTURER'S DIRECTIONS/INSTRUCTIONS/RECOMMENDATIONS/SPECIFICATIONS: Manufacturer's written directions, instruction, recommendations, specifications.
 13. MUST; SHALL; TO; WILL: When used as a directive to Contractor, these terms indicate a mandatory action.
 14. NECESSARY: "Essential to completion of Work".
 15. UNIVERSITY-FURNISHED, CONTRACTOR INSTALLED: "To be furnished by University at its cost and installed by Contractor as part of the Work."
 16. PROJECT SITE; JOB SITE: Geographical location of the Project.
 17. PROVIDE: "Furnish and install".
 18. SHOWN: "As indicated on the Drawings".
 19. SPECIFIED: "As written in the Contract Documents."
 20. SUBMIT: "Submit to University's Representative."

END OF SECTION

SECTION 01100
SPECIAL PROJECT PROCEDURES

1. GENERAL

1.1 HAZARDOUS MATERIALS PROCEDURES

- A. Refer to General Conditions Article 3.19.
- B. Lead Based Paint (LBP):
 - 1. Lead coatings may exist on this Project site, and Work may involve the demolition, removal and disposal of materials coated in LBP. University will disclose all known information about such hazards, including location and quantity of lead in coating materials. If further information is desired, Contractor shall provide sampling and analysis.
 - 2. Where LBP is determined or suspected to exist, Contractor shall comply with all regulations pertaining to its removal, including the Cal/OSHA Lead Construction Standard (CCR Title 8 section 1532.1) and the General Industry Safety Orders hazard communication requirements (CCR Title 8 section 5194). Contractor shall provide all required employee monitoring, personal protective equipment, and engineering controls designed to minimize lead exposures. Contractor is responsible for characterization and disposal of all lead-containing waste and debris. University will provide environmental monitoring.
 - 3. During construction and demolition work, Contractor shall prevent lead dust contamination of surrounding areas. Contractor shall contact University's Office of Environment, Health & Safety regarding all Project elements which may result in significant migration of lead-containing materials off the Project site. Currently, the Department of Toxic Substances Control does not generally consider intact painted building materials to be hazardous wastes. Paint separated from its substrate shall be evaluated independently from the building material to determine proper management. Materials or solvents meeting the requirements of a Federal Hazardous Waste as determined by CCR Title 22 shall be disposed of at a location approved in advance by University's Office of Environment, Health & Safety.

1.2 NOT USED

END OF SECTION

SECTION 01200
PROJECT MEETINGS

1. GENERAL

1.1 PRECONSTRUCTION CONFERENCE

- A. Prior to commencement of Work, a pre-construction conference (Kick-Off Meeting) will be conducted by University's Representative to discuss procedures which are to be followed during performance of the Work.
- B. Location: As designated by University's Representative.
- C. Attending shall be:
 - 1. University's Representative.
 - 2. University.
 - 3. University's consultants and University's Representative's consultants, as appropriate.
 - 4. Contractor.
 - 5. Contractor's Superintendent.
 - 6. Subcontractors, as appropriate.
 - 7. Others, as appropriate.

1.2 BILLING MEETING

- A. A billing meeting shall be conducted by University's Representative each month prior to submittal of the Application for Payment.
- B. Location: As designated by University's Representative.
- C. Attending shall be:
 - 1. University's Representative.
 - 2. University.
 - 3. University's consultants and University's Representative's consultants, as appropriate.
 - 4. Contractor.
 - 5. Contractor's Superintendent.
 - 6. Subcontractors, as appropriate.
 - 7. Others, as appropriate.

1.3 PROGRESS MEETING

- A. During the course of construction, progress meetings will be held to discuss and resolve field problems. Progress meetings will be on a weekly basis unless determined otherwise by University's Representative.
- B. Location: As designated by University's Representative.
- C. Attending shall be:
 - 1. University's Representative.
 - 2. University.
 - 3. University's consultants and University's Representative's consultants, as appropriate.
 - 4. Contractor.
 - 5. Contractor's Superintendent.
 - 6. Subcontractors, as appropriate.
 - 7. Others, as appropriate.
- D. The minutes of these meetings will be prepared by University's Representative and issued as expeditiously as possible to:
 - 1. Contractor (number of copies agreed upon).
 - 2. University's Project Manager (number of copies agreed upon).
- E. Contractor shall submit in writing questions and answers (previously obtained verbally) to be confirmed at each meeting in sufficient numbers for distribution to each person in attendance.

1.4 GUARANTEES, BONDS, AND SERVICE AND MAINTENANCE CONTRACTS REVIEW MEETING

- A. Eleven months following the date of Beneficial Occupancy, Substantial Completion, if applicable, or Final Completion, whichever occurs earliest, a meeting shall be conducted by University for the purpose of reviewing the guarantees, bonds, and service and maintenance contracts for materials and equipment.
- B. Attending shall be:
 - 1. University.
 - 2. University's Consultants, as appropriate.
 - 3. Contractor.
 - 4. Subcontractors, as appropriate.
 - 5. Others, as appropriate.

1.5 MONTHLY STATUS MEETING

- A. Contractor shall review the draft Monthly Status Report with University's Representative in a Monthly Status Meeting on the first work day of each month (refer to Section 01310, CONTRACT SCHEDULES).
- B. Attending shall be:
 - 1. University.
 - 2. University's Consultants, as appropriate.
 - 3. Contractor.

4. Subcontractors, as appropriate.
5. Contractor's Scheduling Organization/Consultant.
6. Others, as appropriate.

END OF SECTION

SECTION 01310
CONTRACT SCHEDULES
(Network Analysis System)

1. GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section identifies the requirements for the development and submittal of the Preliminary 90-Day Schedule, Contract Schedule, Monthly Status Reports and As-Built Schedules. The preparation and submittal of the Contract Schedule, procedures for its approval and revision, and the submittal, review and approval of the Monthly Status Reports are collectively referred to as the Network Analysis System (NAS). The planning, scheduling, management, and execution of the work in accordance with the Contract Documents is the responsibility of Contractor. The NAS requirements are established to ensure the adequate planning, scheduling and management of the Work by Contractor and to enable University's Representative to evaluate Work progress.

1.2 APPROVALS

- A. University's Representative shall have the right to accept or reject the performance by Contractor's own organization or the proposed scheduling consultant.
- B. Acceptance of the Contract Schedule will be a condition precedent to the making of any progress payment for work performed beyond 90 days from receipt of the Notice to Proceed (NTP).
- C. The required schedules and reports shall be prepared and submitted by hand for review and approval in accordance with the General Conditions and this Section.
- D. For submittals due within the first 60 days following NTP, and prior to approval of the Contract Schedule, University's Representative review will not exceed 15 days from receipt of required submittals.
- E. The monthly updating of the Contract Schedule and reports shall be a required element of the estimate upon which progress payments will be made. Submittal by hand by Contractor, and review and approval by University's Representative of these items shall be a condition precedent to the making of progress payments. If, in the judgment of University's Representative, Contractor fails or refuses to provide a complete updated Contract Schedule or reports, as specified, Contractor will be deemed to have not provided the required estimate upon which progress payments may be made, and shall not be entitled to such progress payments unless or until it has furnished the aforesaid schedules.

2. REQUIREMENTS

2.1 NAS COMPONENTS

- A. The NAS is comprised of 6 primary components:
1. Preliminary 90-Day Schedule.
 2. Contract Schedule.
 3. Schedule of Values.
 4. Updates to the Contract Schedule.
 5. Contract Schedule Revisions.
 6. As-Built Schedule.

2.2 PRELIMINARY 90-DAY SCHEDULE

- A. Contractor shall prepare a Preliminary 90-Day Schedule detailing the first 90 days following the issuance of NTP. The Preliminary 90-Day Schedule shall conform to all requirements identified below in Paragraph 2.3, CONTRACT SCHEDULE, with the exception that only those activities projected to begin within the first 90 days of the Contract need to be included. The Preliminary 90-Day Schedule shall be submitted by hand within 10 days of receipt of Notice of Selection as Apparent Lowest Responsible Bidder for review by University's Representative. Upon completion of this review, University's Representative will either approve the Preliminary 90-Day Schedule or direct Contractor to amend and resubmit the Schedule by hand 7 days after receipt of University's Representative's comments.
- B. The Preliminary 90-Day schedule shall identify all work activities which will take place during the first 90 days of the Project. This includes mobilization, submittals, procurement, fabrication, and construction activities. It shall also identify activities and milestones that may affect or be affected by the activities of University, utilities, and/or other third parties.
- C. The Preliminary 90-Day Schedule shall be accompanied by a narrative describing Contractor's approach to mobilization, procurement, and construction during the first 90 days. The narrative shall identify the basis for durations, production rates, equipment to be used, and shall identify major assumptions used to develop the schedule. Mobilization will be broken down into a minimum of two parts including:
1. Job site fencing, equipment, office trailer utility hook-up and furniture.
 2. Job site staff, office supply.
- D. During the first 90 day period, Contractor shall submit by hand a Monthly Status Report on the first working day of the month. This narrative report shall describe the monthly accomplishments for the Project progress achieved to date, as well as objectives for the following month. Problems and proposed corrective action shall be addressed. The report shall be accompanied by an updated Preliminary 90-Day Schedule which identifies progress compared with the approved Preliminary 90-

- Day Schedule and a forecast for all in-progress activities as well as those which have not been started.
- E. The Preliminary 90-Day Schedule, and the logic, sequence and durations for activities contained therein shall establish the basis for all work scheduled during the first 90 days following NTP in the Contract Schedule submittal.
 - F. Contractor shall prepare and submit by hand a Preliminary Schedule of Values with the initial Preliminary 90-Day Schedule and all subsequent Monthly Status Report submittals prior to acceptance of the final Contract Schedule. The Preliminary Schedule of Values shall conform to all requirements identified in Paragraph 2.4, SCHEDULE OF VALUES, herein.
 - G. The Preliminary Schedule and all associated submittals shall be developed utilizing Primavera Suretrak Version 2.0 for Windows or later, or equal scheduling software which is 100% compatible with Primavera. Submit diskette copy to University's Representative.

2.3 CONTRACT SCHEDULE

- A. Contractor shall develop and maintain a network schedule for the Project in accordance with the requirements of this Section, demonstrating fulfillment of all Contract requirements. This Contract Schedule shall identify the planning, coordination and performance of all Work of this Contract, including all activities of Subcontractors, Vendors and Suppliers.
 - 1. The Contract Schedule shall include the following:
 - a. The Contract Schedule shall be comprised of a computer generated, logically networked schedule identifying all activities required to adequately plan and manage the Work to be accomplished. The Contract Schedule shall be a graphic depiction of the construction plan which identifies all sequential elements required to complete the Work and shall be developed utilizing the Precedence Diagram Method format of Critical Path Method (CPM) Scheduling for identifying all interrelationships among the scheduled activities.
 - b. The Contract Schedule and all associated submittals shall be developed utilizing Primavera Suretrak Version 2.0 for Windows or later, or equal scheduling software which is 100% compatible with Primavera. Should Contractor choose to utilize an automated scheduling system other than the above-referenced Primavera systems, Contractor shall, prior to Contractor's development of Preliminary 90-Day Schedule and Contract Schedule and no later than 5 days after the Notice to Proceed, submit same to University's Representative by hand for approval. Prior to approval, Contractor shall, at its cost, demonstrate to University's Representative said software's capability of, as a minimum, producing schedules and documents which meet all criteria specified herein. If University's Representative approves the substitution, Contractor shall, at its cost, provide University with the software, hardware and training sufficient to operate Contractor's system for the duration of the Project.
 - c. All Project/Work Activities shall be of sufficient detail to provide identification of all components utilized in executing, monitoring and evaluating progress of the Work. A Project/Work activity is defined as a schedule element which requires time and resources (manpower, equipment, materials, etc.) to complete in a continuous operation.
 - d. Activity descriptions shall briefly cover the scope of Work indicated. Activities shall be discrete items of Work that must be accomplished under the Contract and constitute definable, recognizable entities within the Project.
 - e. All activities shall have a defined duration. All durations shall be in multiples of working days.
 - f. Activities shall have durations of twenty (20) working days or less. Should an activity require more than twenty (20) working days, it shall be subdivided to define appropriate activities. University's Representative may approve using longer durations on non-construction activities, including the procurement and fabrication of materials and equipment.
 - g. Activities shall include Contract deliverables, including the submittal and approval of permit applications (as necessary), samples of materials, shop drawings, working drawings, inspection and test plans, safety and security plans, worksite control plans, utility company, Point-of-Connection (POC) installations and applications. In addition, activities shall be included for the procurement of materials and equipment impacting the critical path, fabrication of special materials and equipment and their installation and testing, and delivery of University-furnished items. Activities of University that may impact activities shall be reflected, as well as those of utilities and other similarly involved third parties.
 - h. The critical path activities shall be identified, including critical paths for Contract interim and final completion milestone dates. Critical Activities are defined as Work Activities which, if delayed, will delay the scheduled completion of the work (i.e. activities which comprise the path of least total float). All other Work Activities are defined as non-critical and are considered to have float.
 - i. Scheduled start or completion dates imposed on the schedule by Contractor shall be consistent with Contract milestones as identified in the Contract Documents.

- Milestone dates shall be defined as the interim and final completion milestone dates connected to the appropriate activities.
- j. All activities shall be coded to allow logical summarization by Construction Specifications Institute (CSI) Division and Floor (as a minimum). Refer to Part 4, ADDITIONAL SCHEDULE CODING REQUIREMENTS, herein for additional coding requirements.
 - k. All activities for which costs may be associated (i.e. work activities) shall be manpower, resource and cost loaded in accordance with requirements defined herein in Paragraph 2.4, SCHEDULE OF VALUES.
 - l. Failure to include any element of work required for performance of this Contract shall not excuse Contractor from completing work required to achieve milestones, notwithstanding the acceptance of the Contract Schedule submittal.
 - m. All holidays and non-work periods shall be identified in the Contract Schedule's calendar.
 - n. Contractor shall not sequester float through strategies including extending activity duration estimates to consume available float, using preferential logic, using extensive or insufficient crew/resource loading, use of float suppression techniques, special lead/lag logic restraints or imposed dates. Use of float time disclosed or implied by the use of alternate float suppression techniques shall not be for the exclusive use or benefit of either University or Contractor.
 - o. It is acknowledged that University-caused time savings (i.e., critical path submittal reviews returned in less time than allowed by the Contract Documents, approval of substitution requests which result in a savings of time for Contractor, etc.) create float which shall not be for the exclusive use or benefit of either University or Contractor. Accordingly, University-caused delays may be offset by University-caused time savings.
 - p. Refer to General Conditions Paragraph 3.9.
2. Contract Schedule Submittal
- a. The Contract Schedule submittal shall include a Contract Schedule - Time Scaled Logic Diagram, computer generated reports, a computer generated cash flow and direct labor hour curves, and a narrative describing Contractor's approach for meeting the required interim and final completion milestone dates. The above items shall be submitted by hand to University's Representative within 30 days after the date of NTP and shall use the NTP date as day number one. University's Representative will have 15 days after receipt of the submittal to respond. Upon receipt of comments from University's Representative, Contractor shall confer with University's Representative on the appraisal and evaluation of the proposed Contract Schedule. Necessary changes resulting from this review shall be made by Contractor, and the Contract Schedule submittal shall be resubmitted by hand for acceptance within 7 days after the receipt of comments from University's Representative. Upon acceptance, the Contract Schedule shall establish the baseline from which changes in durations and logic will be determined. The logic, sequence and duration for activities for the first 90 days of the Contract Schedule shall be based on the Preliminary 90-Day Schedule. The accepted Contract Schedule shall provide the basis for planning, scheduling, managing and executing the Work to be accomplished by Contractor.
 - b. The Contract Schedule - Time Scaled Logic Diagram shall be time-scaled (by week, starting Monday) and grouped (banded) by work areas and sorted by early start dates. The Contract Schedule shall be clear, neat and legible, and shall be submitted on sheets 30 inches by 42 inches or alternatively on a continuous 36 inch roll on a medium suitable for reproduction. Each sheet shall contain a title block and a revision block.
 - c. Reports and Curves - The initial submittal requires five separate computer generated reports, two separate computer generated cash flow and direct labor hour reports, and one each project cash flow and direct labor hour curve, as described below:
 - 1) Schedule Reports shall contain the following information as a minimum: activity identification number, activity description, estimated total duration, estimated remaining duration, computed or specified early start date, computed early finish date, computed late start date, computed or specified late finish date, and total float. These reports shall be produced as follows:
 - a) Ascending Activity Report - This report shall contain all activities as shown on the Contract Schedule listed in order of ascending activity number.
 - b) Total Float Report - This report shall contain all activities as shown on the Contract Schedule listed in the order of the ascending total float values.
 - c) Early Start Report - This report shall contain all activities as shown on the Contract Schedule listed in chronological order by early start date.

- d) Predecessor/Successor Report - This report shall contain all activities as shown on the Contract Schedule listed in order of ascending activity number, and identify predecessor and successor activity number.
 - e) Subcontractor Activity Report - This report shall contain all activities grouped by Subcontractor as shown on the Contract Schedule listed in chronological order by early start date.
 - 2) Cash Flow and Direct Labor Hour Reports
 - a) Cash Flow Report - This report shall contain activities as shown on the Contract Schedule listed in order of ascending activity number, and identify the total dollar value for each activity. It is recognized that not all costs will be identified by activities in the Contract Schedule. However, the total dollar value in the report must equal the total Contract value.
 - b) Direct Labor Hour Report - This report shall contain activities as shown on the Contract Schedule listed in order of ascending activity number, and identify the total direct labor hour value for each activity.
 - c) Project Cash Flow Curve - This curve shall display by month, the cumulative dollars planned for the duration of the Contract.
 - d) Project Direct Labor Hour Curve - This curve shall display by month, the cumulative direct labor hours planned for the duration of the Contract.
 - d. Narrative - The Contract Schedule submittal shall include a narrative sufficient to explain the basis of Contractor's determination of durations and shall describe Contractor's approach for meeting the required interim and final completion milestone dates, as specified by the Contract. Such explanation shall be a "stand-alone" document that conveys to the reader, at a minimum: Contractor's basis and assumptions; restraints; critical path/activities and why they are critical; equipment requirements; production rates; activities requiring overtime, additional shifts, holidays and special non-workdays; potential problem areas; permits; coordination required with University, utilities or any other parties; and long lead delivery items. Should University's Representative require similar information on other activities, this information shall be supplied by Contractor at no additional cost to University.
 - e. The Contract Schedule submittal shall include a 3½ inch 1.44 MB floppy disk or CD-ROM containing a copy of the Contract Schedule - Time Scaled Logic Diagram, cash flow and direct labor hour data used to develop the submittals. All data shall be written to disk via the P3 Backup utility. If Contractor utilizes a scheduling software system other than Primavera Suretrak Version 2.0 for Windows or later (refer to Paragraph 2.3.A.1.b above), all data shall be written to disk in the manner consistent with said scheduling software for data backup/transfer.
 - f. The Contract Schedule submittal shall include 4 copies of the Contract Schedule - Time Scaled Logic Diagram, computer generated reports, and project cash flow and direct labor hour curves and narrative. Documents in one submittal shall have the same data date irrespective of the dates when the individual documents were prepared.

2.4 SCHEDULE OF VALUES

- A. All work activities which comprise the Contract Schedule and Preliminary 90-Day Schedule shall be manpower, resource and cost loaded and coded by CSI Division as specified in Paragraph 2.3.A.1.j herein. This will allow summarization of project budgets and actual costs by CSI Division (at a minimum) for establishment of the Schedule of Values (for sample, see Schedule 1 of Exhibit 4, APPLICATION FOR PAYMENT, bound herein). This summarization will be the basis for Contractor's monthly Application for Payment. Refer to Part 4, ADDITIONAL SCHEDULE CODING REQUIREMENTS, herein.
- B. The Schedule of Values shall include all Project manpower, resources and costs and shall total to equal the Contract Sum.
- C. Revision to the Schedule of Values shall be in accordance with the requirements specified in Paragraph 2.6, CONTRACT SCHEDULE REVISIONS, herein.

2.5 UPDATES TO THE CONTRACT SCHEDULE

- A. Monthly Status Report:
 - 1. Not later than 30 days after NTP and monthly thereafter, Contractor shall review with University's Representative a draft Monthly Status Report with data as of the date assigned by University's Representative for the reporting period in question. The list of data dates for the contract time of performance will be furnished by University's Representative at the Initial Weekly Progress Meeting (refer to Section 01200, PROJECT MEETINGS).

2. Contractor shall review the draft Monthly Status Report with University's Representative in a Monthly Status Meeting on the first work day of each month (refer to Section 01200, PROJECT MEETINGS). The purpose of the meeting is the joint review and agreement on job status as included in the draft Monthly Status Report.
3. After establishing job status, Contractor shall submit by hand to University's Representative final copies of the Monthly Status Report within 5 days after the date of the review with University's Representative.
4. The Monthly Status Report shall consist of:
 - a. An Updated Contract Schedule - Time Scaled Logic Diagram (format as specified under Paragraph 2.3.A.2.b), computer generated reports (format as specified under Paragraphs 2.3.A.2.c and 2.3.A.2.d) and a 3½ inch 1.44 MB floppy disk or CD-ROM containing an exact copy of the submittal. All data shall be written to disk via the P3 Backup utility (refer to Paragraph 2.3.A.2.e above).
 - b. A Variance Report shall be submitted by hand monthly comparing the approved Contract Schedule with the current month's updated Contract Schedule. The report shall include a description of all activities completed during the preceding month, a description of progress made, and planned activities listed as started but not completed on the updated Contract Schedule, and shall report all activities which have been delayed five (5) or more working days. The format of this report shall include:
 - 1) Activity code and description.
 - 2) Scheduled early start/finish dates.
 - 3) Current anticipated early start/finish dates.
 - 4) Working days remaining to complete the activity.
 - 5) Percentage complete of the activity.
 - 6) Total float of the activity.
 - c. A narrative which identifies the work actually completed and reflects the progress along the critical path in terms of days ahead of or behind the Contract interim and final completion milestone dates as specified in the Contract Documents. Specific requirements of the narrative are as follows:
 - 1) Actual completion dates for activities completed during the report period.
 - 2) Actual start dates for activities started during the report period.
 - 3) Estimated start dates for activities scheduled to start during the month following the report period.
 - 4) Changes in the duration(s) of any activities and/or logic changes to activities which were performed in a different sequence than the accepted Contract Schedule.
 - 5) Identification of the current critical path(s) to interim and final completion milestones.
 - 6) Activities proposed to be added to the Contract Schedule.
 - 7) Identification of executed Change Orders that will be incorporated into the Contract Schedule, following approval by University's Representative.
 - 8) The narrative shall identify any variances or changes in the direct labor hour allocation, the cause, and the activities affected, and shall provide an explanation of the proposed corrective action to meet the planned allocation as in the accepted Contract Schedule.
 - d. If the Monthly Status Report indicates an actual or potential delay to the Contract interim or final completion milestone dates as specified in the Contract Documents, Contractor shall identify the problem, cause, and the specific activities affected and shall provide a proposed corrective action plan to mitigate the indicated delays.
 - e. Updated Project Cash Flow and Direct Labor Hour Curves:
 - 1) Updated Project Cash Flow Curve which displays the cumulative planned versus cumulative actual as of the report period. Also, Contractor shall include a forecast of cost for the remaining Contract duration.
 - 2) Updated Project Direct Labor Hour Curve which displays the cumulative planned versus cumulative actual as of the report period. Also, Contractor shall include a forecast of direct labor hours for the remaining Contract duration.
 - f. Incorporation of all University's Representative accepted schedule revisions.
 - g. The mutually agreed-to Monthly Status Report shall be the basis for evaluating Contractor's progress. Documents in a single Monthly Status Report shall have the same data date irrespective of the dates of preparation of the individual documents.
 - h. If the latest completion time for any required interim or final completion milestone date as indicated by the current Monthly Status Report does not fall within the time allowed by the Contract, Contractor shall prepare and submit by hand a fragnet, as described in Paragraph 2.6 herein, from the Contract Schedule which

identifies the plan to recover the lost time. Such recovery measures as concurrent operations, logic and sequence changes, additional manpower, additional shifts, or overtime, shall be adopted to ensure that Contract interim and final completion milestone dates will be met. Such fragnet schedules shall not be incorporated into the Contract Schedule until it has been reviewed and approved by University's Representative.

5. University's Representative may call for more frequent Contract Schedule status meetings (weekly, biweekly, etc.) at no cost to University at which Contractor will provide the required information.
6. Weekly Updates:
 - a. The Contract Schedule shall be updated to include current Project progress on a weekly basis.
 - b. Contractor shall prepare a Three Week Look-Ahead Schedule including a Three Week As-Built Schedule based on the Contract Schedule, for submittals and review at the Weekly Progress Meeting.

2.6 CONTRACT SCHEDULE REVISIONS

- A. Revisions to the accepted Contract Schedule shall be introduced to University's Representative in a Time Impact Analysis package, including a separate fragnet schedule for review and approval prior to incorporation into the current Contract Schedule. This fragnet shall adhere to the requirements identified in Paragraph 2.3.A in the development of revisions and must clearly outline the impact of the revision within the context of the Contract Schedule. Each proposed revision shall be submitted on separate fragnets taken from the proposed revision with the following minimum components:
 1. A time scaled logic diagram showing revised and affected activities, and how these activities are incorporated into the current Contract Schedule.
 2. An Activity Report and Predecessor/Successor Report as specified in Paragraph 2.3.A.2.c for all revised and affected activities.
 3. A narrative report identifying Contractor's basis for determining activity durations, assumptions, restraints, requirements and required coordination necessary to complete the revised/affected work contained in the fragnet schedule.
 4. All work activities contained in the fragnet schedule shall be manpower, resource and cost loaded.
 5. Any request for an adjustment of the Contract Time for completion submitted by Contractor by hand for changes or alleged delays shall be accompanied by a complete Time Impact Analysis, which shall be submitted by hand for review within 20 days after the request by Contractor. Time extensions will not be granted unless substantiated by the Contract Schedule, and then not until the Project float becomes zero.
 6. The Time Impact Analysis shall be determined on the basis of the date or dates when the change or changes were issued, or the date or dates when the alleged delay or delays began. The status of the Project and Time Impact Analysis shall include event time computation for all affected activities.
 7. University's Representative may require that Time Impact Analysis be provided in order to demonstrate the time impact upon the overall Project and the time for completion, at no additional cost to University.
 8. If University's Representative determines after review of the Time Impact Analysis that Contractor is entitled to any extension of time for completion, the time for completion will be adjusted accordingly by University's Representative, and Contractor shall then revise the Contract Schedule accordingly.
 9. The Contract Schedule will be used in the calculation of liquidated damages or Compensable Delay for each day of delay after the Contract completion date, as adjusted, until the Work is accepted.
- B. Upon acceptance of the fragnet, all schedule, direct labor hour and cash flow data shall be added or revised for all new and/or revised activities for incorporation into the current Contract Schedule.
- C. Revisions to the Contract Schedule shall include a 3½ inch 1.44 MB floppy disk or CD-ROM containing a copy of the proposed revision. All data shall be written to disk via the P3 Backup utility (refer to Paragraph 2.3.A.2.e above).

2.7 CONTRACT TIME ADJUSTMENTS

- A. Float time is not time for the exclusive use or benefit of either University or Contractor. Extensions of time for Contract performance as specified in the Contract will be granted only to the extent that time adjustments to the affected work items exceed the total float time along the affected paths of the Contract Schedule current at the time of the delay. Refer to General Conditions Article 8.3.

2.8 AS-BUILT SCHEDULE AND DOCUMENTATION

- A. Within 30 days after final acceptance of the Work by University, Contractor shall submit by hand for University's Representative acceptance, an As-Built computer generated report, an As-Built Contract Schedule - Time Scaled Logic Diagram, and As-Built computer generated cash flow and direct labor hour curves. The documents shall be prepared in accordance with the requirements for Contract record drawings specified in Section 01720, PROJECT RECORD DOCUMENTS, and in Paragraph 2.3.A.2 above. Final payment of retention will not be paid until this work is accomplished.

2.9 NAS DOCUMENTS

- A. Once accepted by University's Representative, and until they are superseded by subsequent approved iterations, NAS documents are part of the Contract and shall be used by Contractor for planning, organizing, and directing its work, for reporting progress and cash flow distribution and for determining adjustments to interim and final completion milestone dates as specified in the Contract Documents.
- B. Suspension of Payments: Should Contractor's NAS document submittals not be approved, University may suspend monthly progress payments for all or any portion of work performed per General Conditions Article 9.2. When Contract Schedules, or revisions as appropriate, satisfy the Contract Specifications and present a realistic approach to the Work required to meet the Contract completion date/interim milestone dates and form the basis for a reasonable cash flow distribution, University's Representative will approve the Contract Schedule and University will resume making progress payments. The determination as to whether the foregoing conditions have been met will be in the sole opinion of University's Representative, based on information furnished by Contractor as to Contractor's equipment, resources, crew sizes, crafts, planned unit rates, reasonableness of procurement times, costs, and other pertinent factors.

2.10 LOOK AHEAD SCHEDULES

- A. Contractor shall develop and furnish throughout the Project a 2-3 Week Look Ahead Schedule indicating upcoming general areas of work, and a 2-3 Day Look Ahead Schedule indicating specific work activities within those areas specified in the 2-3 Week Look Ahead Schedules. These schedule updates shall be used to coordinate with occupants within the planned work areas and to schedule access to specific work locations.

3. SUBMITTALS

3.1 GENERAL

- A. Except as modified in this Section 01310, the procedures specified in Section 01340, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, shall be observed.
- B. Contractor shall submit by hand 1 reproducible and 4 blue-line prints/copies of each required schedule and report. Contractor shall also submit by hand a copy of the computer data used to produce the submittal via floppy disk as stated in this Section. Refer to Paragraph 2.2.B and 2.3.A.1.g herein.

3.2 CONTRACTOR'S SCHEDULING ORGANIZATION/CONSULTANT

- A. Within 10 days following receipt of Notice of Selection as Apparent Lowest Responsible Bidder and with signed Agreement, and prior to engaging a consultant or commencing performance of the work specified in this Section with its own forces, Contractor shall submit by hand to University's Representative for approval:
 - 1. Information sufficient to show that Contractor's own organization or Contractor's proposed scheduling consultant has staff and computer facilities meeting the requirements specified herein.
 - 2. A list of prior projects for which Contractor's own organization or proposed scheduling consultant or staff thereof has performed services similar to those required for this Contract. Experience on a minimum of three (3) prior projects of similar size, and cost, and complexity is required.

3.3 PRELIMINARY 90-DAY SCHEDULE SUBMITTALS

- A. Bar chart schedule.
- B. Narrative of the schedule basis.
- C. Schedule of Values.

3.4 CONTRACT SCHEDULE SUBMITTALS

- A. Contract Schedule - Time Scaled Logic Diagram.
- B. Computer generated reports.
- C. Computer generated cash flow curve.
- D. Narrative of the schedule basis.
- E. Schedule of Values.

3.5 STATUS REPORTS

- A. Monthly Status Report Submittals:
 - 1. Updated Contract Schedule - Time Scaled Logic Diagram.
 - 2. Computer generated reports.
 - 3. Computer generated cash flow curve.
 - 4. Computer generated direct labor hour curve.
 - 5. Narrative of the schedule status.
 - 6. Schedule of Values.
- B. Weekly Three Week Look-Ahead Report.

3.6 REVISIONS TO CONTRACT SCHEDULE SUBMITTALS

- A. Contract Schedules - Time Scaled Logic Diagram.
- B. Computer generated reports.
- C. Computer generated cash flow curve.
- D. Computer generated direct labor hour curve.

- E. Narrative of the schedule basis.
- F. Schedule of Values.

3.7 AS-BUILT SCHEDULE DOCUMENTATION

- A. Contract Schedules - Time Scaled Logic Diagram.
- B. Computer generated reports.
- C. Computer generated cash flow curve.
- D. Computer generated direct labor hour curve.
- E. Narrative of the schedule basis.
- F. Schedule of Values.

4. ADDITIONAL SCHEDULE CODING REQUIREMENTS

4.1 GENERAL

- A. In addition to the requirements specified in Paragraph 2.3.A.1.j, comply with the following.
 - 1. Activity Identification Number: Each activity shall be identified by a unique nine (9) digit alpha/numeric code structured/partitioned as follows:
 - a. Sequence Numbers (First 5 Digits - Left Justified): This element shall be comprised of a numeric or alpha/numeric combination such that when combined with the additional three Activity Identification Number elements, provides a unique identifier.
 - b. Project Identifier (6th Digit from Left): The following character codes shall be utilized with this position to identify the Project elements:
 - 1) S – SOD-TIER Network Installation
 - c. Construction Specifications Institute (CSI) Division (7th and 8th Digits from Left):
 - 1) 01 - General Requirements
 - 2) 02 - Sitework
 - 3) 03 - Concrete
 - 4) 04 - Masonry
 - 5) 05 - Metals
 - 6) 06 - Wood and Plastics
 - 7) 07 - Thermal and Moisture Protection
 - 8) 08 - Doors and Windows
 - 9) 09 - Finishes
 - 10) 10 - Specialties
 - 11) 11 - Equipment
 - 12) 12 - Furnishings
 - 13) 13 - Special Construction
 - 14) 14 - Conveying Systems
 - 15) 15 - Mechanical
 - 16) 16 - Electrical
 - 17) 17 - Hazardous Materials/Asbestos Abatement
 - d. Floor Identifier (9th Digit from Left):
 - 1) 1 - First Floor
 - 2) 2 – Second Floor
 - 3) 3 - Third Floor
 - 4) 4 - Fourth Floor
 - 5) 5 - Fifth Floor
 - 6) 6 - Sixth Floor
 - 7) 7 - Seventh Floor
 - 8) 8 - Eighth Floor
 - 9) 9 - Ninth Floor
 - 10) 10- Tenth Floor
 - 11) A - A Level
 - 12) B - B Level
 - 2. Activity Coding: The following codes shall be applied as a minimum for all scheduled activities; additional codes may be added/used by Contractor for special requirements.
 - a. Project Phase:
 - 1) 0 - Submittals/Preconstruction
 - b. Sub-Phase:
 - 1) C - Construction
 - 2) S - Staging
 - c. Work Type:
 - 1) 05 - Submittals
 - 2) 10 - Asbestos Abatement
 - 3) 15 - Demolition
 - 4) 20 - Utilities
 - 5) 25 - Underground Utilities
 - 6) 30 - Excavation/Foundation/Slab-On-Grade
 - 7) 35 - Columns
 - 8) 40 - Walls
 - 9) 45 - Structural Steel

- 10) 50 - Plumbing
- 11) 55 - Fire Sprinklers
- 12) 60 - Mechanical/HVAC
- 13) 65 - Electrical
- 14) 70 - Drywall/Paint
- 15) 75 - Millwork/Casework
- 16) 80 - Fixtures/Hardware/Floor Coverings
- 17) 95 - Irrigation/Landscaping
- 18) 99 - Punch List
- d. Responsibility: Additional codes shall be defined by Contractor to identify responsible subcontractors.
 - 1) O - University

END OF SECTION

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA & SAMPLES

1. GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Shop Drawings, Product Data, and Samples, other than in connection with proposed substitutions, shall be submitted to University's Representative only when specifically required; and University's Representative will not review any other such submittals. Product Data and Samples for proposed substitutions shall be submitted to University's Representative in accordance with Section 01630, PRODUCT OPTIONS AND SUBSTITUTIONS. Contractor shall be responsible for obtaining such copies of Shop Drawings, Product Data, and Samples as it may require for its own use.

1.2 RELATED REQUIREMENTS

- A. Definitions:
1. The terms "Shop Drawings" and "Product Data" as used herein also include fabrication, erection, layout and setting drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams, all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment, or systems and the positions thereof conform to the Contract Documents.
 2. As used herein, the term "manufactured" applies to standard units usually mass-produced. The term "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop Drawings shall establish the actual detail of all manufactured or fabricated items, indicate correct relation to adjoining Work, and amplify design details of mechanical and electrical equipment in accurate relation to physical spaces in the structure.
- B. Manufacturers' Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed in accordance with a specified product manufacturer's instructions, Contractor shall procure and distribute the necessary copies of such instructions to University's Representative and all other concerned parties; and Contractor shall furnish, install, or perform the Work in strict accordance therewith.
- C. Submittal Schedule:
1. A schedule for submission of Shop Drawings, Product Data, and Samples by Contractor (the "Submittal Schedule"), and their processing and return by University's Representative, shall be agreed upon by both parties in order that the items covered by these submittals will be available when needed by the construction process and so that each party can plan its workload in an orderly manner.
 2. Contractor shall prepare the Submittal Schedule using a form to be furnished by University's Representative at the Pre-Construction Meeting (see Section 01200, PROJECT MEETINGS) and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted by hand to and accepted by University's Representative, except in such cases where the processing of submittals is required before the acceptance of the Submittal Schedule.
 3. In preparing the Submittal Schedule, Contractor shall first determine from the Contract Schedule the date the particular item is needed for the Work. Working backwards, Contractor shall add the required number of days for shipment, time for fabrication, and similar items to determine the date of the first submittal.
 4. The Submittal Schedule shall be adjusted to meet the needs of the construction process and Contract Schedule. Submit by hand 2 copies of the Submittal Schedule after it is completed and each time it is updated by Contractor.

1.3 SHOP DRAWINGS

- A. Present information required on Shop Drawings in a clear and thorough manner. Identify details by reference to drawing and detail, schedule, or room numbers shown and specified. The room numbers referenced or shown shall be the University-assigned room numbers, which Contractor can obtain from University's Representative.

1.4 PRODUCT DATA

- A. Preparation:
1. Clearly mark each copy to identify pertinent products or models.
 2. Show performance characteristics and capacities.
 3. Show dimensions and clearances required.
 4. Show wiring or piping diagrams and controls.
- B. Manufacturers' standard schematic drawings and diagrams:
1. Modify the standard schematic drawings and other diagrams to delete information which is not applicable to the Work.
 2. Supplement standard information to provide information specifically applicable to the Work.

1.5 SAMPLES

- A. Office Samples shall be of sufficient size and quality to clearly illustrate the following:
 - 1. Functional characteristics of the products, with integrally related parts and attachment devices.
 - 2. Full ranges of color, texture, and pattern.
- B. Field Samples and Mock-Ups:
 - 1. Erect at the Project site, at a location as directed by University's Representative.
 - 2. Size: As specified.
 - 3. Fabricate each Sample and mock-up to be complete and fully finished.
 - 4. Remove mock-ups at conclusion of Work.

1.6 CONTRACTOR'S REVIEW OF SUBMITTALS

- A. Review, mark up as appropriate, and stamp Shop Drawings, Product Data, and Samples prior to submission. Submittals shall clearly show that they have been reviewed by Contractor for conformance with the requirements of the Contract Documents and for coordination of the Work.
- B. Determine and Verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar data.
 - 4. Conformance with Contract Documents.
- C. Coordinate each submittal with requirements of the Work and of the Contract Documents.
- D. Notify University's Representative in writing, at time of submission, of any changes in the submittals from requirements of the Contract Documents.
- E. Begin no fabrication or Work which requires submittals until the return of University's Representative's final reviewed submittals.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with the Submittal Schedule and in such sequence as to cause no delay in the Work or in the work of any Separate Contractor.
- B. Number of Submittals Required:
 - 1. Shop Drawings: Submit 1 opaque bond copy (plus additional copies as if specified in technical specifications or requested by University's Representative). After checking, University's Representative will make prints for itself, University and their consultants, and then return the reproducible copy to Contractor. Contractor may make prints as it requires for its use and for Subcontractors' use.
 - 2. Product Data and Non-Reproducible Submittals: Submit the number of copies which Contractor will need, plus 3 copies which will be retained by University's Representative.
 - 3. Samples: Submit the number specified in the Section which requires them.
- C. Submittals shall contain:
 - 1. Date of submission and dates of any previous submissions.
 - 2. Project name and number.
 - 3. Contract identification.
 - 4. The names of:
 - a. Contractor.
 - b. Subcontractor.
 - c. Supplier.
 - d. Manufacturer.
 - 5. Identification of the product, with the Specification Section number.
 - 6. Field dimensions, clearly identified as such.
 - 7. Relation to adjacent or critical features of the Work or materials.
 - 8. Reference standards, such as ASTM or Federal Specification numbers.
 - 9. Identification of changes from requirements of the Contract Documents.
 - 10. Identification of revisions on resubmittals.
 - 11. An 8-inch x 3-inch blank space for review stamps.
 - 12. Contractor's stamp, initialed or signed, certifying to the review of the submittal; verification of materials and field measurements and conditions; and compliance of the information within the submittal with requirements of the Work and of the Contract Documents.
- D. Resubmission Requirements:
 - 1. Shop Drawings and Product Data:
 - a. Revise Shop Drawings or Product Data, and resubmit as specified for the initial submittal.
 - b. Identify any changes which have been made other than those requested.
 - c. Note any departures from the Contract Documents or changes in previously reviewed submittals which were not commented upon by University's Representative.
 - 2. Samples: Submit new samples as required for initial submittal.
- E. Distribution:
 - 1. Reproduce and distribute copies of Shop Drawings and Product Data, which carry University's Representative's review stamp, to the following locations:
 - a. Contractor's Project site file.
 - b. Record documents file maintained by Contractor.

- c. Separate Contractors.
 - d. Subcontractors.
 - e. Supplier or manufacturer.
 - 2. Distribute samples which carry University's Representative's review stamp as directed.
- F. University's Representative's Review: University's Representative will review Contractor's submittals, such as Shop Drawings, Product Data, and Samples, for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of such submittals is not conducted for the purpose of determining the 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 Contractor as required by the Contract Documents.

END OF SECTION

SECTION 01400
QUALITY CONTROL

1. GENERAL

1.1 GENERAL

- 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 and performing other services as determined by University.
 2. The term "Contractor's Testing Laboratory" means a testing laboratory retained and paid for by Contractor to perform the testing services required by the Contract Documents. Contractor's Testing Laboratory shall be an organization other than University's Testing Laboratory and shall be acceptable to University's Representative. It may be a commercial testing organization, the testing laboratory of a trade association, the certified laboratory of a supplier or manufacturer, Contractor's own forces, or other organization. Contractor's Testing Laboratory shall have performed testing of the type specified for at least 5 years.
- B. Tests, inspections, and acceptances of portions of the Work required by the Contract Documents or by Applicable Code Requirements shall be made promptly to avoid delay of the Work. Except as otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with Contractor's Testing Laboratory. Contractor shall give University's Representative timely notice of when and where tests and inspections are to be made.
- C. If such procedures for testing, inspection, or acceptance reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for University's Representative's services and expenses.
- D. If University's Representative is to observe tests, inspections, or make acceptances required by the Contract Documents, University's Representative will do so promptly and, where practicable, at the normal place of testing.
- E. Do not incorporate into the Work materials represented by samples under test without the written approval of University's Representative.

1.2 CONTRACTOR'S RESPONSIBILITIES REGARDING UNIVERSITY'S TESTING LABORATORY

- A. Secure and deliver to University's Testing Laboratory specified quantities of representative samples of materials proposed for use as specified.
- B. Submit to University's Testing Laboratory the preliminary design mixes proposed to be used for concrete and other materials which require review by University's Testing Laboratory.
- C. Submit copies of product test reports as specified.
- D. Furnish incidental labor and facilities:
1. To provide University's Testing Laboratory access to Work to be tested.
 2. To obtain and handle samples at the Project site or at the source of the product to be tested.
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- E. Provide written notice to University's Representative and University's Testing Laboratory 72 hours in advance of operations to allow for assignment of personnel and scheduling of tests.
- F. When tests or inspections are not performed after such notice, Contractor shall reimburse University for University's Testing Laboratory personnel and travel expenses incurred.

1.3 TESTS AND INSPECTIONS

- A. Certain portions of the Work will be tested and/or inspected at various stages. Nothing in any prior acceptance or satisfactory test result shall govern, if at any subsequent time the Work, or portion thereof, is found not to conform to the requirements of the Contract Documents.
- B. Not Used.

1.4 ADDITIONAL TESTING AND INSPECTION

- A. If initial tests or inspections made by University's Testing Laboratory or University's Geotechnical Engineer reveal that any portion of the Work does not comply with Contract Documents, or if University's Representative determines that any portion of the Work requires additional testing or inspection, additional tests and inspections shall be made as directed.
1. If such additional tests or inspections establish that such portion of the Work complies with the Contract Documents, all costs of such additional tests or inspections shall be paid by University.
 2. If such additional tests or inspections establish that such portion of the Work fails to comply with the Contract Documents, all costs of such additional tests and inspections, and all other costs resulting from such failure, including compensation for University's Representative and University's consultants, shall be deducted from the Contract Sum.

1.5 TEST REPORTS

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

- B. University's Representative will distribute 1 copy of the reports to University, University's Consultants, and Contractor.

1.6 GEOTECHNICAL ENGINEER

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

END OF SECTION

SECTION 01420
INSPECTION OF WORK

1. GENERAL

1.1 ACCESS TO THE WORK

- A. In addition to the requirements of the General Conditions, University, University's Representative and their representatives shall at all times have access to the Work wherever it is in preparation or progress and Contractor shall provide safe and proper facilities for such access and for inspection. The inspection and written acceptance of material and workmanship, unless otherwise stated in these Specifications, shall be final except as provided in Article 12.2 of the General Conditions.

1.2 TESTING AND APPROVAL

- A. In addition to the requirements of the General Conditions, if any law, ordinance or public authority or the Specifications or University's Representative's instructions require any work to be specially tested or approved (including use of ionizing radiation for radiography), Contractor shall give University's Representative timely notice of its readiness for inspection, and if the inspection is by another authority than University's Representative, of the date fixed for such inspection.
- B. Re-examination of questioned work may be ordered by University's Representative.

1.3 UNIVERSITY'S INSPECTORS

- A. University shall supply personnel, reporting to University's Representative, who shall observe construction in progress. Inspectors shall have the following responsibilities and limitations on authority:
1. Act under the direction of University's Representative.
 2. Observe installations and work in progress as a basis for determining conformance of the work, materials and equipment with the Construction Documents. Inspector will report any discrepancies observed to University's Representative and Contractor. Only University's Representative has the authority to make approvals or rejections.
 3. Only University's Representative shall interpret the requirements of the Construction Documents. If any item is ambiguous, University's Representative shall make a written interpretation. If Contractor requests changes or modifications to the Construction Documents, University's Representative shall make a written determination on the requested changes or modifications.
 4. Prepare and submit an inspection report to University's Representative for each inspection performed.
 5. Review the monthly progress payment request before Contractor submits it to University's Representative.
 6. Assist University's Representative in reviewing the test and inspection results of testing laboratories.
 7. The Inspector is not authorized to permit deviations from the requirements of the Contract Documents unless such deviation has been approved by University's Representative in writing.
 8. The Inspector is not authorized to advise on or issue directions to Contractor about any aspect of construction means, methods, techniques, sequences or procedures, or relating to safety programs in connection with the Project.
- B. The failure of University, University's Representative and its representatives and consultants, or University's Inspector to observe or inspect the Work, or to detect deficiencies in the Work, or to inform Contractor of any deficiencies which may be discovered, shall not relieve Contractor, its subcontractors regardless of tier, or suppliers from their responsibility for construction means, methods, techniques, sequences and procedures, construction safety, nor from their responsibilities to carry out the work in accordance with the Contract Documents and to detect and correct defective work. The term "defective work" means work that is unsatisfactory, faulty, omitted, incomplete, deficient, or does not conform to the requirements of the Contract Documents, directives of University's Representative, or the requirements of any inspection, reference standard, test, or approval specified in the Contract Documents, or has been damaged prior to final completion, unless responsibility for the protection of such work has been assumed by University through beneficial occupancy in accordance with Article 9.6 of the General Conditions or through substantial completion in accordance with Article 9.7 of the General Conditions.

1.4 INSPECTION REQUESTS

- A. Contractor shall request inspection of completed portions of the Work through University's Representative at least 72 hours in advance of the inspection to be performed. Contractor shall submit said request for inspection using a form to be furnished by University's Representative at the Pre-Construction Meeting (see Section 01200, PROJECT MEETINGS).
- B. For each inspection request received from Contractor for which University's Representative determines that such work is not ready for inspection, University will backcharge Contractor the amount of (\$75.00) per hour as partial compensation for the University's Inspector's time spent to respond to the unnecessary request.

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES & TEMPORARY CONTROLS

1. GENERAL

1.1 PROTECTION OF EXISTING STRUCTURES AND UTILITIES (Refer also to General Conditions)

- A. The Drawings show, if applicable, existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, and other utilities which are known to University.
- B. Locate all known existing utility installations before proceeding with construction operations which may cause damage to such installations. The existing installations shall be kept in service where shown and damage shall be repaired with no adjustment of Contract Sum.
- C. If any other structures or utilities are encountered, request University's Representative to provide direction on how to proceed with the Work.
- D. If any structure or utility is damaged, take immediate action to ensure the safety of persons and property.
- E. Shoring:
 - 1. General Protection. Pursuant to Labor Code Sections 6705 and 6707, Contractor shall include in its base bid all costs incident to the provision of adequate sheeting, shoring, bracing or equivalent method for the protection of life and limb which shall conform to the applicable Federal and State Safety Orders.
 - 2. Before beginning excavation five feet or more in depth, Contractor shall submit to University's Representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation. The proposed plan shall comply with the standards established by the California Construction Safety Order and Title 24 of the California Code of Regulations (CCR). If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, University's Representative's determination of the matter shall be final and conclusive on Contractor and University. The cost of any required engineering services shall be borne by Contractor and shall be deemed to have been included in the Contract Sum.
 - 3. Neither the review nor approval of any plan showing the design of shoring, bracing, sloping, or other provisions for worker protection shall relieve Contractor from its obligation to comply with Construction Safety Orders Standards and CCR, Title 24, for the design and construction of this protective Work, and Contractor shall indemnify University and University's Representative from any and all claims, liability, costs, actions and causes of action arising out of or related to the failure of these protective systems. Contractor shall defend University and its officers, employees, and agents, and University's Representative in any litigation of proceeding brought with respect to the failure of these protective systems.
 - 4. Comply with State of California Construction Safety Orders, Article 6 - Excavations, Trenches, Earthwork – whether or not the excavation, trench, or earthwork is five feet or more in depth.

1.2 INTERRUPTION OF UTILITIES/BUILDING SERVICES

- A. Maintain continuous utility services to all existing facilities during the period of construction except for the following conditions:
 - 1. Perform Work that involves "shut-down" of existing facilities at such times as will cause the least inconvenience to the University activities, performing at night, on Saturdays, Sundays, holidays and at the discretion of University's Representative. Furnish University's Representative written notice of exact date and time of "shut-down" at least 15 working days in advance, unless a longer period is specified or shown on the Drawings. On jobs with short performance time, Contractor shall verify with University's Representative the number of days required in advance for shut-down.
 - 2. Include in Contractor's bid the cost of overtime necessary for the Work. No extra payment will be allowed for overtime to meet this requirement or the Contract Schedule.

END OF SECTION

SECTION 01510
TEMPORARY UTILITIES

1. GENERAL

1.1 DESCRIPTION

- A. Provide and maintain temporary utilities for construction operations and related necessary temporary structures. Remove them when they are no longer needed.
- B. Pay for connections for water and electricity to Project site sources.
- C. University does not guarantee amounts of water and electricity available from existing University's sources, nor will University be responsible for interruptions in service.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

- A. Install and use temporary utilities in accordance with requirements specified in Section 01060, REGULATORY REQUIREMENTS, and all Applicable Code Requirements.

2. MATERIALS

2.1 GENERAL

- A. Materials may be new or used, but shall be adequate for the required purposes. Their use and methods of installation shall not create unsafe conditions or violate requirements of applicable codes and requirements.

2.2 TOILET FACILITIES

- A. Toilet facilities for use by workers on the job or other personnel of Contractor will be provided by University in existing toilet facilities; these shall be used for toilet purposes only and not for disposal of materials or cleaning of tools.

2.3 TEMPORARY TELEPHONE

- A. Telephone service will not be provided by University, except in case of emergency involving life and safety. Contractor shall use the public pay phones available on campus or, after coordinating with University's Representative, make arrangements with the telephone company for temporary telephone service.

2.4 TEMPORARY ELECTRIC SERVICE

- A. University will furnish electric power for construction purposes at no cost to Contractor.
 - 1. The characteristics of current furnished by University are limited to that existing and available. If current of other characteristics or quantity is required by Contractor, it shall supply the power as necessary at no extra cost to University.
 - 2. All parts of the permanent electrical system used for construction purposes shall be operated in a manner so as to ensure the safety of all personnel and to prevent interference with the orderly progress of the Work.
 - 3. Contractor shall repair and make good all damage to existing electrical facilities caused by Contractor's use, as requested and approved.
- B. Furnish, install and maintain all temporary electrical equipment and connections (including, without limitation, conduit and wires, drops, circuit breaker and disconnect switches) as necessary for the Work.
- C. Service connections shall be made by Contractor to the existing electrical distribution system at the following point(s) of connection:
 - 1. Power for small tools and lighting may be taken from the existing 120 Volt 60 Hz 1-phase convenience receptacles in the building.
 - 2. Power for larger equipment may be taken directly from the existing 208Y/120V 3-phase 4-wire lighting panelboard on the same floor of this Project.
- D. The load connected to any circuit shall not exceed 25% of the circuit or feeder capacity as labeled in the panelboard.
- E. There shall be no disturbance to building occupants and functions. Cables and conductors shall not prevent closing of fire labeled doors.
- F. Before final acceptance, all temporary equipment and connections installed by Contractor shall be removed in a manner approved by University's Representative.

2.5 TEMPORARY WATER

- A. Water service outlet shall be provided at locations where shown and as approved. Contractor shall furnish, install and maintain necessary temporary supply connections, piping, fittings, etc., as necessary for the Work. Before final acceptance, all temporary connections and piping installed by Contractor shall be removed in a manner approved by University's Representative. Water will be provided by University at Contractor's expense.
 - 1. Contractor shall furnish and install a double check valve assembly, water meter, and pressure regulator, approved by University's Representative, at the point of connection to University's water system.

2.6 TEMPORARY FIRE PROTECTION

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

1. Install a reduced pressure type backflow device, approved by University's Representative, at point of connection to University's water system.
- B. Use fire protection equipment only for fighting fires.

2.7 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to meet specified minimum conditions for installation of materials; and to protect equipment, materials, and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas to cure installed materials, to prevent excessive humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.

3. EXECUTION

3.1 GENERAL

- A. Comply with applicable requirements specified in Section 01060, REGULATORY REQUIREMENTS, DIVISION 15 - MECHANICAL and in DIVISION 16 - ELECTRICAL.
- B. Maintain and operate systems to provide continuous service.
- C. Modify and extend systems as required.

3.2 REMOVAL AND RECONDITIONING

- A. Remove all temporary services installed as a requirement of the Contract Documents. Restore utilities to their original condition at the completion of the Work.
- B. Legally and properly dispose of all debris resulting from removal and reconditioning operations.

END OF SECTION

SECTION 01560
ENVIRONMENTAL MITIGATION

1. GENERAL

1.1 DUST CONTROL, AIR POLLUTION AND ODOR CONTROL

- A. Contractor shall employ measures to prevent the creation of dust, air pollution and odors.
1. Unpaved areas where vehicles are operated shall be periodically wetted down or given an equivalent form of treatment as defined in Air Quality Management District (AQMD) Rule 403 to eliminate dust formation.
 2. All volatile liquids including fuels or solvents shall be stored in closed containers.
 3. No open burning of debris, lumber or other scrap will be permitted.
 4. Equipment shall be maintained in a manner to reduce gaseous emissions.
 5. Use alternative fuel construction equipment (i.e., compressed natural gas, liquid petroleum gas, unleaded gasoline) and low-emission diesel construction equipment to the extent that the equipment is readily available and cost effective.
 6. Stockpiles of excavated materials shall be covered with material approved by University's Representative.
 7. Refer to Section 01710, CLEAN-UP & DISPOSAL, Paragraph 3.1.B, for silt clean up.
 8. Comply with SCAQMD Rule 403.

1.2 NOISE CONTROL

- A. The following noise control procedures shall be employed:
1. Maximum Noise: The Contractor shall use equipment and methods during the course of this work that are least disruptive to adjacent offices or residences. Noise levels for trenchers, graders, trucks and pile drivers shall not exceed 90 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA at 50 feet.
 - a. Do not use chop saws for cutting metal framing members, straps or supports. Use band saw or other cutting method to reduce noise during "normal" work hours.
 2. Equipment: Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. All diesel equipment shall have exhaust muffled. Air compressors shall be of a quiet type such as a "whisperized" compressor.
 3. Operations: Machines shall not be left idling. Electric power shall be used in lieu of internal combustion engine power wherever possible. Equipment shall be maintained to reduce noise from vibration, faulty mufflers, or other sources.
 4. Scheduling: Noisy operations shall be scheduled so as to minimize their disturbance to occupied adjacent areas and duration at any given location.

END OF SECTION

SECTION 01600
MATERIAL & EQUIPMENT

1. GENERAL

1.1 TRANSPORTATION AND HANDLING

- A. Deliver manufactured products in their original unbroken containers or bundles, clearly labeled with manufacturer's name, brand, and grade seal or model number.
- B. Keep materials clean, dry, and undamaged. Handle materials and equipment in a manner to avoid damage to products and their finishes.
- C. Promptly remove damaged or defective products from the Project site and replace with no adjustment of Contract Sum.

1.2 STORAGE AND PROTECTION

- A. Store manufactured products in accordance with manufacturers' instructions and with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Maintain temperature and humidity in accordance with manufacturers' recommendations (refer to Section 01510, TEMPORARY UTILITIES).
- B. Exterior Storage:
 - 1. Store materials and equipment above ground on blocking or skids to prevent soiling, staining, and damage.
 - 2. Cover products which are subject to damage by the elements with impervious protective sheet coverings. Provide adequate ventilation to prevent condensation.
 - 3. Store sand, rock, or aggregate material in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage to allow adequate inspection.
- D. Periodically inspect stored products to assure that products are maintained under specified conditions and are free from damage and deterioration.
- E. Use of mechanical and electrical rooms for storage of materials or furniture is prohibited.
- F. Protection After Installation:
 - 1. Prevent damage to materials and equipment.
 - 2. Use whatever protective materials or methods are necessary to prevent damage to installed products from traffic, construction operations, and weather. Remove protection when no longer required.
 - 3. Maintain temperature and humidity conditions in interior spaces for the Work in accordance with manufacturers' instructions for the materials and equipment being protected.

1.3 UNDERWRITERS LABORATORIES, INC. (UL) LABEL

- A. Materials and equipment, for which UL standards have been established and their label service is available, shall bear the appropriate UL Label.

1.4 MANUFACTURERS' TRADE MARKS AND NAMES

- A. University's Representative reserves the right to review and request the removal or redesign of manufacturers' trade marks and names on items of materials and equipment which will be exposed to view in the completed Work. Such removal or redesign shall be with no adjustment of Contract Sum.

END OF SECTION

SECTION 01630
PRODUCT OPTIONS & SUBSTITUTIONS

1. GENERAL

1.1 GENERAL PROVISIONS REGARDING SPECIFICATION OF PRODUCTS, MATERIAL OR EQUIPMENT BY BRAND OR TRADE NAME

- A. Products, material or equipment specified by both brand or trade name and model number are approved for use, provided that Contractor complies with all Contract requirements. Specification of a product, material or equipment by brand or trade name and model number is not a representation or warranty that the product, material or equipment can be used without modification, to meet the requirements of the plans and specifications; Contractor shall, at its sole cost, modify such products, material, or equipment so that they comply with all requirements of the plans and specifications.
- B. The first-named product, material or equipment specified by brand or trade name and model number is the basis for the Project design and the use of any item other than the first-named one may require modifications of that design. If Contractor uses any product, material or equipment other than the first-named one, Contractor shall, at its sole cost:
 - 1. Make all revisions and modifications to the design and construction of the Work necessitated by the use the product, material or equipment.
 - 2. Be responsible for all costs of any changes resulting from the use of the product, material or equipment including costs or changes which affect other parts of the Work, the work of Separate Contractors, or any other property or operations of University.
- C. When a product, material or equipment specified by brand or trade name is followed by the words "or equal," a substitution may be permitted if the substitution is equal to or superior to the first-named product, material or equipment in quality, utility and appearance, and if the substitution complies with all other requirements of the plans and specifications.
- D. A product, material or equipment specified by brand or trade name followed by the words "or equal, no known equal," signifies that University does not have sufficient knowledge to specify a product, material or equipment, other than the one specified by brand or trade name, that is suitable for use on the Project. The use of the words "no known equal" is not intended to discourage substitution requests in accordance with the requirements specified herein.
- E. When catalog numbers and specific brands or trade names not followed by the designation "or equal" are used in conjunction with a product, material or equipment required by the specifications, substitutions will not be allowed and the named product, material or equipment must be used.
- F. Specification of a product, material or equipment by brand or trade name and model number is not a representation or warranty that the product, material or equipment is available; Contractor shall confirm, prior to submitting its Bid, the availability of any product, material or equipment specified by brand or trade name and model number.

1.2 SPECIAL REQUIREMENTS FOR PRODUCTS, MATERIAL OR EQUIPMENT, OTHER THAN THE FIRST-NAMED PRODUCT, MATERIAL OR EQUIPMENT, SPECIFIED BY BOTH BRAND OR TRADE NAME AND MODEL NUMBER.

- A. In addition to complying with all other submittal requirements of the Contract, submit within 70 days after the date of commencement specified in the Notice to Proceed, for review and approval by University's Representative, Contractor-prepared specifications and drawings, including design and engineering calculations, prepared by an appropriate licensed professional, depicting all revisions and modifications to the design and construction of the Work necessitated by the use of the product, material or equipment. If no revisions or modifications are necessary, submit within 70 days after the date of commencement specified in the Notice to Proceed, a written representation that no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment. Contractor shall utilize the first-named product, material or equipment if Contractor fails to make the appropriate required submittal pursuant to this paragraph within the 70-day period.
- B. A product, material or equipment, other than the first-named product, material or equipment, specified by both brand or trade name and model number may be used if no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment. If such revisions or modifications are necessary, the product, material or equipment may be used only if the revisions or modifications are approved in writing by University's Representative. Contractor has the burden of demonstrating, through the procedures specified herein, that any such revisions or modifications will not be detrimental to the quality, utility or appearance of the Project or any portion of the Project. The University's Representative may refuse to approve any such proposed revisions or modifications where, in the reasonable opinion of University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the revisions or modifications are not detrimental to the quality, utility or appearance of the Project or any portion of the Project.

1.3 SPECIAL REQUIREMENTS FOR SUBSTITUTIONS

- A. In addition to complying with all other submittal requirements of the Contract, submit written data demonstrating that the proposed substitution is equal to or superior to the first-named product, material or equipment in quality, utility and appearance and otherwise complies with all requirements of the plans and specifications, including:

1. Complete technical data including drawings, performance specifications, samples, and test reports of the article proposed for substitution.
 2. Statement by Contractor that the proposed substitution is in full compliance with the requirements of the Contract Documents and Applicable Code Requirements.
 3. List of Subcontractors, if any, that may be affected by the substitution.
 4. Contractor-prepared specifications and drawings, including design and engineering calculations, prepared by an appropriately licensed professional, depicting all revisions and modifications to the design and construction of the Work necessitated by the use of the substitution. If no revisions or modifications are necessary, submit a written representation that no revisions or modifications to the design or construction of the Work are necessitated by the use of the product, material or equipment.
- B. At the request of and within the timeframes specified by University's Representative:
1. Submit samples as deemed necessary by University's Representative to evaluate the proposed substitution.
 2. Submit proposed substitution to tests deemed necessary by University's Representative to evaluate the proposed substitution. Such tests shall be made by an independent Testing Laboratory and at the sole expense of Contractor, after review and approval of the test procedures by University's Representative. If re-testing is deemed necessary by University's Representative to evaluate the proposed substitution, such re-testing shall be made by an independent Testing Laboratory at the sole expense of the Contractor.
 3. Provide all additional information deemed necessary by University's Representative to evaluate the proposed substitution.
- C. If University's Representative, in reviewing a proposed substitution, requires revisions or corrections to be made to previously accepted shop drawings and supplemental supporting data to be resubmitted, Contractor shall do so within the time period specified by University's Representative. A proposed substitution may be rejected if Contractor fails to submit such revisions, corrections, or supplemental supporting data within the specified time period.
- D. Except for products, material or equipment designated in the Bidding Documents for evaluation of substitutions prior to award, requests for substitution, including the data required by Paragraph 1.3.A herein, must be submitted to University's Representative not later than 35 days after the date of commencement specified in the Notice to Proceed. No requests for substitutions of products, material or equipment subject to the 35-day deadline shall be considered unless the request and supporting data is submitted on or before the deadline, except those deemed, in University's Representative's sole opinion, to be necessary because (i) previously specified or approved manufactured products, material or equipment are no longer manufactured, (ii) of University initiated change orders, or (iii) it is in the best interest of University to accept such substitution.
- E. If a product, material or equipment is designated in the Bidding Documents for evaluation of substitutions prior to award, then a request for substitution of the product, material or equipment, including the data required by Paragraph 1.3.A herein, must be submitted by the deadline specified in the Bidding Documents. Because of time constraints, only one submittal will be allowed for each such substitution request. Requests for substitutions of products, material or equipment designated for evaluation prior to award may not be made after the deadline specified in the Bidding Documents, and such requests shall not be considered unless the request and supporting data is submitted on or before the deadline specified in the Bidding Documents. Notwithstanding the forgoing, University may consider, after award of the Contract, requests for substitution of a product, material or equipment designated for evaluation prior to award where, in University's Representative's sole opinion, a substitution is necessary because (i) previously specified or approved manufactured products, material or equipment are no longer manufactured, (ii) of University initiated change orders, or (iii) it is in the best interest of University to accept such substitution.
- F. In reviewing the supporting data submitted for substitutions, University's Representative will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications. If more than 2 submissions of supporting data are required, the cost of reviewing the additional supporting data shall be at Contractor's expense.
- G. Contractor has the burden of demonstrating, through the procedures specified herein, that its proposed substitution is equal to or superior to the first-named product, material or equipment in quality, utility and appearance and complies with all other requirements of the plans and specifications. If revisions or modifications to the design or construction of the work are necessitated by the use of the substitution, Contractor also has the burden of demonstrating, through the procedures specified herein, that the use of the substitution will not be detrimental to the quality, utility or appearance of the Project or any portion of the Project.
- H. The University's Representative may refuse to approve any requested substitution where, in the reasonable opinion of University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the proposed substitution is equal to, or superior to, the first-named product, material or equipment, in quality, utility and appearance and that the proposed substitution complies with all other requirements of the plans and specifications.
- I. University's Representative may reject any substitution not proposed in the manner and within the time limits prescribed herein.
- J. Substitutions are not allowed unless approved in writing by University's Representative. Any such approval shall not relieve Contractor from the requirements of the Contract Documents.

- K. The 35-day and 70-day submittal periods do not excuse Contractor from completing the Work within the Contract Time or excuse Contractor from paying liquidated damages if Final Completion is delayed.
- L. If revisions or modifications to the design or construction of the Work are necessitated by the use of a substitution, the substitution may be used only if the revisions and modifications are approved in writing by University's Representative. The University's Representative may refuse to approve any such proposed revisions or modifications where, in the reasonable opinion of University's Representative, Contractor has failed to demonstrate, through the procedures specified herein, that the revisions or modifications are not detrimental to the quality, utility and appearance of the Project or any portion of the Project.
- M. If a substitution request is finally rejected by University Representative, Contractor shall furnish and install:
 - 1. the first-named product, material, or equipment; or
 - 2. a product, material, or equipment, other than the first-named product, material or equipment, specified by both brand or trade name and model number, provided Contractor complies with the submittal requirements (including deadlines) specified in Paragraph 1.2 herein.

END OF SECTION

SECTION 01710
CLEAN UP & DISPOSAL

1. GENERAL

1.1 DESCRIPTION

- A. Clean up and disposal.

2. PRODUCTS (Not Applicable)

3. EXECUTION

3.1 CONTINUOUS CLEAN UP

- A. Under no circumstances shall rubbish, debris, waste, dust, dirt, or surplus materials be allowed to accumulate in the building, or on the Project site, and all such materials shall be removed continually as the Work progresses. In addition, at the end of each shift, Contractor shall leave corridors and work areas clean (including removal of debris, work materials, tools, etc.), and provide at minimum a broom-swept finish.
1. Materials: In occupied building areas, only sufficient materials and flammable or toxic substances necessary for the Work being performed that day or shift shall be brought into the building and work areas. In no case shall flammable or toxic substances be stored in the building, and these substances shall be immediately removed from the building when not needed and not later than the end of the day's Work.
 2. Splatterings or spills of materials shall be promptly cleaned up at time of occurrence.
- B. Contractor shall provide street sweeping whenever silt from construction site is carried over to adjacent public thoroughfares.

3.2 FINAL CLEAN UP

- A. University's Representative's Inspection: Notify University's Representative at least 24 hours in advance of readiness for inspection. Any deficient cleaning operations, as determined by University's Representative, shall be immediately corrected as approved at Contractor's expense.
- B. Interior surfaces and areas where Work is performed shall be left in vacuum clean condition with all dust, dirt, stains, handmarks, paint spots, plaster droppings, and other blemishes and defects completely removed. To the extent of Contractor's operations, use or materials, the following requirements apply to all areas where Work is performed:
1. Walls: Bare and painted surfaces shall be cleaned and free of dust, lint, streaks, or stains.
 2. Hardware and metal surfaces shall be cleaned and polished using non-corrosive and non-abrasive materials.
 3. Glass: New glass and soiled existing glass shall be washed and polished both sides and left free of dirt and spots. Labels shall be removed.
 4. Ceilings shall be clean and free of stains, handmarks, and defacing.
 5. Fixtures and Equipment: New mechanical and electrical fixtures and like items shall be cleaned and polished. Lighting fixtures shall be free of dust, dirt, stains, or waste material. Equipment and machinery shall be cleaned, serviced, and ready for use. Existing items shall be cleaned as required including ventilating supply and return equipment in walls and ceilings.
 6. Surfaces not mentioned shall be cleaned according to the intent of this Section and as required for University's Representative's approval.

3.3 DISPOSAL

- A. Under no circumstances shall debris, rubbish, or waste material be disposed of on University's property by burying or otherwise, and all shall be removed from University's property to a legal disposal area. Contractor shall bear all dumping charges.
- B. Contractor is prohibited from cleaning out buckets, containers, and tools contaminated with paints, plaster, or any other materials in University storm drains.

3.4 CORRECTIVE WORK

- A. Where existing Work has been dirtied, stained, defaced, or otherwise made defective and cleaning operations are not satisfactory, as determined by University's Representative, Contractor shall remove the Defective Work and install new Work as requested and approved, at no extra cost to University.

3.5 CLEAN UP SPECIFIED IN OTHER SECTIONS

- A. Any clean up specified in other Sections of these Specifications shall be in addition to, and not in lieu of, these requirements.

END OF SECTION

SECTION 01720
CONTRACTOR'S AS-BUILT DOCUMENTS

1. GENERAL

1.1 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store Contractor's as-built documents and Samples in Contractor's field office separate from documents used for construction.
- B. Maintain as-built documents in order and in a clean, dry, legible condition.
- C. Do not use as-built documents for construction.

1.2 AS-BUILT DOCUMENTS

- A. University's Representative will, at no cost, provide Contractor with a set of reproducible Drawings of the original Contract Documents, which shall be used for recording the "as-built" condition of the Work.
- B. As-Built Drawings: Record the following kinds of information on the As-Built Drawings:
 - 1. Locations of Work buried under or outside the building, such as plumbing and electrical lines and conduits. Provide horizontal and vertical dimensions from fixed points.
 - 2. Actual numbering of each electrical circuit.
 - 3. Locations of all HVAC, plumbing and electrical Work concealed inside the building; and other work that is changed by Contractor from that shown on the Drawings.
 - 4. Locations of all items, not necessarily concealed, which vary from the locations shown on the Drawings.
- C. The following requirements for As-Built Drawings are in addition to those specified elsewhere:
 - 1. They shall be done carefully and neatly by a competent drafter, familiar with the Work involved, using methods acceptable to University's Representative.
 - 2. They shall be kept up to date during the entire progress of the Work and made available to University's Representative at any time.
 - 3. Additional drawings shall be provided as required to accurately describe changes.
 - 4. Record all changes in size, location, and other features of installation shown on the Drawings.
 - 5. Record all locations of underground Work, points of connection, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
 - 6. Record sufficient information such that Work concealed in the building may be located with ease and accuracy. This may be accomplished by dimensioning or by stating the relationship to the spaces in the building near which the Work was installed. University's Representative's decision on what constitutes sufficient information shall be final.
- D. Shop Drawings: Provide final Shop Drawings which have been updated to show actual conditions, for Work specified in the individual Sections.
- E. Specifications and Addenda:
 - 1. Record the following:
 - a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - b. Changes made by Addenda, Change Order, or Field Order, and clarifications and interpretations made by Letter of Instruction.

END OF SECTION

SECTION 01740
GUARANTEES, WARRANTIES, BONDS, SERVICE & MAINTENANCE CONTRACTS

1. GENERAL

1.1 GENERAL

- A. Guarantees from Subcontractors shall not limit Contractor's warranties and guarantees to University. 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.

1.2 FORM OF GUARANTEE

- A. Submit written guarantees in the form contained at the end of this Section.

1.3 SUBMITTAL REQUIREMENTS

- A. Assemble required guarantees, bonds, and service and maintenance contracts.
B. Number of original signed copies required: 2 each.
C. Table of Contents: Neatly typed and in orderly sequence. Provide complete information for each item as follows:
1. Product or Work item.
2. Firm name, address, and telephone number; and name of principal.
3. Scope.
4. Date of beginning of guarantee, bond, or service and maintenance contract.
5. Duration of guarantee, bond, or service and maintenance contract.
6. Contractor's name, address, and telephone number; and name of responsible principal.
7. Provide information for University's personnel:
a. Correct procedure in case of failure.
b. Circumstances which might affect the validity of guarantee or bond.

1.4 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
B. Format:
1. Size 8½-inch x 11-inch sheets punched for 3-ring binder. Fold larger sheets to fit into binders.
2. Identify each packet on the cover with typed or printed title "GUARANTEES AND BONDS," and the following:
a. Title of Project.
b. Name of Contractor.
C. Binders: Commercial quality, 3-ring, with durable and cleanable plastic covers.

1.5 TIME OF SUBMITTALS

- A. Within 10 days after the date of Substantial Completion, and prior to request for final payment.
B. For Work activities, where Final Completion is delayed materially beyond the date of Substantial Completion, provide updated submittal within 10 days after Final Completion, listing the date of Final Completion as the start of the Guarantee To Repair Period.

1.6 SUBMITTALS REQUIRED

- A. Submit guarantees, bonds, and service and maintenance contracts specified in the individual Sections.

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GUARANTEE

Date: _____

Project Name: _____

Project Number

Order Number

Project Location: _____

GUARANTEE FOR _____ (the "Contract"), between The Regents of the
(Specification Section); Contract No.

University of California ("University") and _____ ("Contractor").

_____ hereby guarantees to University
(Name of Subcontractor)

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 Number: _____

Address: _____

Phone Number: _____

CONTRACTOR

Signed: _____ Title: _____

Typed Name: _____

Name of Firm: _____

END OF SECTION

SECTION 02080- ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes the proper set-up, removal, decontamination, and disposal of the following asbestos-containing materials/asbestos-containing construction materials (ACMs/ACCMs) and Presumed ACMs (PACMs):

1.	Vinyl Floor Tile/Sheeting (Various Sizes) (Spot Abatement)	100 Square Feet
2.	Floor Tile/sheeting Mastic (Various Sizes) (Spot Abatement)	100 Square Feet
3.	Data Cable Supports/Core Drilling/Equipment Fasteners (Floors)	100 Square Feet
4.	Pipe/Fitting Insulation (Various Sizes) (Spot Abatement) Data Cable Supports/"J" Hooks/Equipment Fasteners	100 Linear Feet
5.	Pipe/Fitting Insulation (Various Sizes) (Spot Abatement) Debris on Ceilings	100 Square Feet
6.	Spray-Applied Fireproofing (Spot Abatement) (4 TH Floor)	50 Square Feet
7.	Spray-Applied Fireproofing - Contactor Assist (Spot Abatement) Data Cable Supports/"J" Hooks/Equipment Fasteners	25 Locations
8.	Vinyl Floor Tile (Various Sizes)	1,100 Square Feet
9.	Floor Tile Mastic	1,100 Square Feet
10.	Vinyl Basecove and Mastic (Various Sizes)	550 Linear Feet

- B. All quantities listed above are approximate, and may not represent actual conditions. Verify actual quantities and sizes by field observation, review of as built drawings or other suitable method.

1.2 RELATED WORK

- A. Section 01014: Contractor's Use of the Project Site
- B. Section 01060: Regulatory Requirements
- C. Section 01340: Shop Drawings, Product Data and Samples
- D. Section 01500: Construction Facilities and Temporary Controls
- E. Section 01510: Temporary Utilities
- F. Section 01630: Product Options and Substitutions
- G. Section 02081: Lead Removal

1.3 SCOPE OF WORK

- A. This section covers providing all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements, and waste transport and disposal necessary to perform the work required for asbestos abatement in accordance with these specifications, drawings and notations, United

States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), National Institute of Safety and Health (NIOSH), State of California regulations, South Coast Air Quality Management District, and City of Los Angeles Fire Department and all other Applicable Code Requirements.

- B. The work specified herein is the abatement, clean-up and disposal of ACMs by competent persons trained, knowledgeable, and qualified in the techniques of abatement, handling, and disposal of asbestos-containing and asbestos-contaminated materials, and the subsequent cleaning of contaminated areas; who comply with all Applicable Code Requirements; and who are capable and willing to perform the work according to the Contract Documents.
- C. The work shall also include providing all necessary means of accessing work areas including removal and reinstallation of doors; temporary ramps, platforms and stairways.

1.4 DISPOSAL REQUIREMENTS

- A. Dispose of all asbestos waste at one of the following approved facilities:
 - 1. Waste Management (Azusa Land Reclamation)
1201 West Gladstone St.
Azusa, CA 91702
(626) 334-0719
 - 2. Clean Harbors (Lokem)
2500 W. Lokem Road
Buttonwillow, CA 93206
(805) 762-6200
 - 3. Chemical Waste Management (CWM) – Kettleman Hills
35251 Old Skyline Road
Kettleman City, CA 93239
(559) 386-9711
- B. Dispose of mastic remover/stripper and materials contaminated with mastic as Resource Conservation and Recovery Act (RCRA) Waste. Unless waste analysis performed by a certified laboratory shows the waste to be within Land Disposal Restriction (LDR) limits, the required disposal method is incineration. Presently, the only approved facilities are:
 - 1. Clean Harbors (Los Angeles), Inc.
5756 Alba Street
Los Angeles, CA 90058
(213) 585-5063
 - 2. PSC Environmental
425 Isis Avenue
Inglewood, CA 90301
(323) 776-6233
- C. Other facilities may be used only if prior written approval is obtained from the University's Office of Environment, Health & Safety (EH & S).
- D. Document actual disposal of the waste at the designated landfill by completing Waste Manifest (s), and Waste Certification Form (s), and by ensuring their proper completion by the University's Representative, waste transporter, and waste disposal site operator.
 - 1. Within 24 hours of the time waste materials have been removed from the site, deliver all landfill receipts, trip tickets, manifests or other documentation of disposal to:

Environment, Health & Safety
501 Westwood Plaza, 4th Floor
Box 951605,

University of California
Los Angeles, California 90095-1605
Attn: Mr. Dave Ott

2. Utilize manifest (s) to accompany each load of waste that leaves the site. Include the name and address of the Generator (University), Contractor, pick-up site, disposal site, estimated quantity of asbestos waste disposed and the type of container utilized. Obtain signatures of the Generator's Representative, Transporter and the Disposal Site Operator as the responsibility of the material changes hands.
 3. Secondary Transporters are not allowed unless approved in writing by the University's Representative.
- E. Dispose of all friable materials deemed and/or presumed to contain or be contaminated with asbestos as hazardous regulated asbestos waste in a minimum of two (2) 6-mil polyethylene clear disposal bags. Utilize burlap, reinforced polyethylene bags, or other suitable containers to dispose of waste (e.g., wire lath, straps, etc.) that will rip, tear, or puncture disposal bags. Evacuate air from bags using a HEPA vacuum and seal bags using duct tape and the "Gooseneck" seal technique. Transport on a hazardous waste manifest. Label the outer bags or containers with the following:
1. United States Department of Transportation (USDOT) waste classification placards and the following description:

RQ Asbestos, 9, NA, 2212, PG III, NAERG 171

2. OSHA Warning Labels:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

3. California EPA Warning Labels

HAZARDOUS WASTE
STATE AND FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
IF FOUND, CONTACT THE NEAREST
POLICE OR PUBLIC SAFETY AUTHORITY
OF THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES

4. Generator Name and Address and Disposal Identification Number

- F. Dispose of all non-friable and associated materials deemed to contain or be contaminated with asbestos as non-hazardous regulated asbestos waste in a minimum of two (2) 6-mil polyethylene clear disposal bags. Utilize burlap, reinforced polyethylene bags, or other suitable containers to dispose of waste (e.g., roofing, wire lath, straps, etc.) that will rip, tear, or puncture disposal bags. Seal bags using duct tape and the "Gooseneck" seal technique. Transport on a non-hazardous waste manifest. Label the outer bags or containers with the following description:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

- G. Dispose of all FTM/mastic remover/stripper and associated contaminated materials (e.g., rags, cloths, etc.) separately from asbestos waste in lockable "ring" top 55-gallon steel drums.

- H. Prepare all waste transportation containers as follows:
1. Following removal from the project site, immediately load all asbestos waste into an enclosed cargo area of a truck, bin or dumpster for transport to the landfill.
 2. Immediately clean up any debris or residue observed on waste containers, carts, or surfaces outside the work area resulting from waste transport and loading activities using HEPA vacuums and/or wet methods as appropriate.
 3. Provide an enclosed cargo area of a truck, bin or dumpster that is free of debris, and line with a minimum of one (1) layer of 6-mil fire-resistant polyethylene sheeting to prevent contamination from leaking containers.
 4. Provide an enclosed cargo area of a truck, bin or dumpster with doors or tops that can be closed and locked to prevent vandalism or other disturbance of the packaged asbestos waste and wind dispersion of asbestos fibers. Secure and lock the door or top all times with the exception of loading and unloading of asbestos waste.
 5. Do not place loose, unbagged material or non-asbestos waste in the enclosed cargo areas of a truck, bin or dumpster.
 6. Place bags, do not throw them into the waste containers to prevent splitting and the release of asbestos fibers.
 7. Place drums or wrapped components on level surfaces in the cargo area and pack together to prevent shifting or tipping.
 8. Place drums or wrapped components on level surfaces in the cargo area and pack together to prevent shifting or tipping:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1.5 APPLICABLE STANDARDS AND GUIDELINES

- A. All work conducted in conjunction with asbestos-related activities shall comply with all Applicable Code Requirements, including those listed below. The publications listed below are incorporated into this specification and shall be considered as if printed herein.
1. Code of Federal Regulations (CFR):
 - a. 29 CFR §1926.050 Stairways and Ladders
 - b. 29 CFR §1910.134 Respiratory Protection
 - c. 29 CFR §1910.145 Specifications for Accident Prevention Signs and Tags
 - d. 29 CFR §1926.1101 Construction Standard – Asbestos
 - e. 29 CFR §1926.59 Hazard Communication – Construction
 - f. 29 CFR § 1200 Hazard Communication – General Industry
 - g. 29 CFR § 1926.450-454 Scaffolds and Training
 - h. 40 CFR 61 Subpart A General Provisions (EPA)
 - i. 40 CFR 61 Subpart M National Emissions Standards for Hazardous Air Pollutants (EPA NESHAP)
 - j. 40 CFR Part 763, Subpart E EPA AHERA Regulations
 - k. 49 CFR § 172 US Department of Transportation (USDOT)
 2. California Code of Regulations (CCR):
 - a. 8 CCR §1529 Construction Industry Safety Orders Asbestos
 - b. 8 CCR §5144 Respiratory Protective Equipment
 - c. 8 CCR §341.6 Registration, Asbestos Related Work
 - d. Title 22 Hazardous Waste Handling

- e. 8 CCR §5194 Hazard Communication
 - f. 8 CCR §3203 Injury and Illness Prevention
- Program
- 3. American National Standards Institute (ANSI) Publications:
 - a. ANSI Z9.2 - 79: Fundamentals Governing the Design
and
Operation of Local Exhaust Systems
 - b. ANSI Z88.2 - 80: Practices of Respiratory Protection
- 4. Cal. Lab, Code Sections 6501.5, 6501.8, and 6503.5.
- 5. American Society for Testing and Material (ASTM) Publication:
 - a. E 1368-97 Standard Practice for Visual
Inspection of
Asbestos Abatement Projects
 - b. D2986-95a Standard Practice for Evaluation of
Air Assay
Media by the Monodisperse DOP
(Diocetyl
Phthalate) Smoke Test
- 6. Underwriters Laboratories, Inc. (UL) Publication:
 - a. High Efficiency Particulate Air
(HEPA) Air Filtration Units
- 7. South Coast Air Quality Management District
 - a. Rule 1403
- 8. City of Los Angeles Fire Department (LAFD) Rule No. 68

1.6 SUBMITTALS AND NOTIFICATIONS

- A. Related Specifications Sections
 - 1. SECTION 01340 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
 - 2. SECTION 01630 PRODUCT OPTIONS AND SUBSTITUTIONS
- B. Furnish the following to the University's Representative at least 14 days prior to mobilization:
 - 1. Registration with the Division of Occupational Safety and Health (DOSH) as an asbestos abatement Contractor per the requirements in 8 CCR §341.6 through 341.14.
 - 2. A marked-up, site-specific set of floor plans showing locations and lay-out of work area enclosures, decontamination units, air filtration devices, temporary fire protection, waste containers, utility (e.g., water, electrical sources), staging areas, and emergency exiting from the building.
 - 3. Prior to job start, notify all appropriate agencies of the planned abatement activities, including:
 - a. South Coast Air Quality Management District (SCAQMD)
 - b. California Division of Occupational Safety and Health (DOSH)
 - c. City of Los Angeles Fire Department (Courtesy notification; payment of the fee is not required)
 - 4. Documentation of satisfactory employee, "competent person", and supervisor training per 29 CFR §1926.1101 and 8 CCR §1529, in addition to AHERA Worker or Supervision/Contractor Certification. Include copies of current (to within one year) supervisor/worker certificates showing the dates of training and training entity.
 - 5. A certificate signed by a licensed physician certifying that each project supervisor/worker is physically able to wear the required respiratory protection and has been examined in accordance with the medical monitoring requirements of 29 CFR § 1926.1101 and 8 CCR § 1529 within the previous year.
 - 6. Copies of the Contractor's Emergency Preparedness Plan to include the following:
 - a. Project site layout, location of emergency exits, fire protection equipment (e.g., hydrants, standpipes, and sprinkler shut offs, etc.).

- b. Considerations of fire, explosion, electrical hazards, slips, trips and falls, confined spaces, and heat-related injury.
 - c. Project specific periodic training of employees in evacuation procedures in the event of work place emergencies.
 - d. Description of evacuation procedures in the event of work place emergencies.
 - e. Locations and telephone numbers of all emergency response personnel.
 7. Current qualitative or quantitative respirator fit testing and training records for all project supervisors/workers which meet the requirements of 29 CFR §1910.134, 29 CFR §1926.1101, 8 CCR §5144, and 8 CCR §1529.
 8. The names, addresses, telephone numbers, and certification/registration numbers of the transporters and disposal site(s) proposed to be utilized for disposing of asbestos-containing/contaminated waste materials.
 9. Written notification to the rental agency regarding intended use of the rental equipment, and a copy of same submitted to the University's Representative when rental equipment is to be used in abatement areas.
 10. Manufacturer's product data and Material Safety Data Sheets (MSDS) for water-actuated rewettable cloth to be used to repair damaged pipe/fitting insulation.
- C. Submit to the University's Representative on a daily basis or whenever requested during the progression of the work, the items listed below. Maintain a copy of the items listed below on the project site at all times:
 1. Copies of Contractor's respiratory protection program and injury and illness protection program.
 2. Manufacturer's product data and Material Safety Data Sheets (MSDS) for all materials to be used as part of abatement activities.
 3. SCAQMD permits for all HEPA vacuums and negative air filter units to be used on the project site.
 4. Supervisor's daily reports detailing abatement activities, worker and visitor access problems and corrective actions taken or proposed, injury reports, equipment breakdown, etc.
 5. Logs documenting filter changes on HEPA vacuums, negative air filter units, and shower filters.
 6. Initial air monitoring results for HEPA negative air filter unit exhaust as required by SCAQMD. Collect air samples on the first day of abatement activities.
 7. An updated spreadsheet in Microsoft Excel (hard and electronic copies) showing the names, social security numbers, training expiration dates, medical monitoring expiration dates, and fit test expiration dates for all employees assigned to the project.
 8. Copies of all transport manifests with actual weight recorded in pounds or weighmasters certificates for all asbestos waste materials removed from the work area during the abatement process.
 9. All personnel air sampling results in accordance with 29 CFR §1926.1101. Post within 24 hours after the collection of the samples.
- D. Product Options and Substitutions:
 1. Refer to Section 01630, PRODUCT OPTIONS AND SUBSTITUTIONS.
- E. Submit the following bound close-out documents to the University's Representative within 30 days following completion of the project:
 1. Two Copies of Project Log Book as described in 1.6.B and C (cumulative).
 2. Asbestos Work Description Form (attached at the end of this Section).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Store all materials at the project site or inside the work area that are subject to damage off the ground away from wet or damp surfaces, and under protective cover to prevent damage or contamination.

- B. Do not use and remove all previously used, damaged and/or deteriorating materials from the premises.
- C. Deliver materials in the original packages, containers, or bundles bearing the name of the manufacturer and brand name.
- D. Utilize UL rated, flame-retardant, polyethylene sheeting (opaque in color), or spray-plastics, of 6-mil thickness or greater, in sizes to minimize the frequency of joints.
- E. Utilize duct tape capable of sealing joints or adjacent sheets of plastic, facilitating attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials, and adhering under both dry and wet conditions, including during the use of amended water.
- F. Utilize methylene chloride free spray adhesive capable of providing additional sealing of joints, attachment of plastic sheeting to unfinished surfaces, and adhering under dry and wet conditions, including during the use of amended water. Do not use spray adhesive on vinyl or fabric surfaces to remain, or on masonry.
- G. Utilize low odor and non-corrosive mastic remover. Manufacturers: Sentinel, Product - 747™ or equal.
- H. Utilize new (not previously used) minimum ½” in thickness, “C” grade, and certified as fire retardant plywood material for the construction of barriers, tunnels, and floor protection.
- I. Utilize absorbent (e.g., kitty litter, sawdust) material capable of quickly and efficiently soaking up excess emulsifying solvent.
- J. Utilize airtight and watertight containers to receive and retain any asbestos-containing or contaminated materials for storage until disposal at a disposal site. Label the containers as specified herein.
- K. Utilize clear 6-mil thickness polyethylene bags, metal, fiberglass, or plastic drums with locking ring tops as the waste properties require, for waste storage or disposal.
- L. Utilize warning signs in accordance with OSHA standard 29 CFR §1926.1101 paragraph k(1)(ii).
- M. Provide any other signs, labels, warning, and posted instructions that are necessary to protect, inform, and warn people of the hazard from asbestos exposure, including signs required under California Health and Safety Code Section 25916 (Prop 65).
- N. Utilize non-flammable encapsulating agents that shall adhere to the substrate from where asbestos is to be removed, and do not affect replacement materials ability to bond to the substrate, nor reduce the UL rating of the replacement material.
- O. Utilize surfactant (wetting agent) mixture of 50/50 polyoxyethylene ether and polyoxyethylene ester, or equivalent, mixed with water in accordance with manufacturer’s printed instructions.

2.2 EQUIPMENT

- A. Provide scaffolds and ladders of sufficient dimension and quantity so that all work surfaces can be easily and safely reached by workers and inspectors. Seal scaffold joints and ends with tape to prevent incursion of asbestos fibers. Comply with 29 CFR § 1926.050 and 8 CCR §1629 and 1646 requirements when using ladders and scaffolding and incorporate guardrails, midrails, toerails, and wheel locks as required.
- B. Provide a sufficient quantity of negative pressure air filtration units equipped with HEPA filtration and operated in accordance with ANSI Z9.2-79 (local exhaust ventilation requirements) and EPA guidance

document EPA 560/5-83-002 Guidance for Controlling Friable Asbestos-Containing Materials in Buildings. Calculate total air flow requirement as follows:

$$\text{Total ft}^3/\text{min} = \frac{\text{Vol. of work area (in ft}^3\text{)}}{15 \text{ minutes}}$$

1. To calculate the number of units needed for the abatement:

$$\text{Number of units needed} = \frac{[\text{total ft}^3/\text{minutes}]}{[\text{capacity of unit in ft}^3/\text{minute}]}$$

- C. Provide a single switch or set of switches for the emergency shutdown of all negative pressure equipment by fire department personnel. Locate the switches in a non-contaminated area near the clean exit of the decontamination unit. Identify using a sign with minimum 3" X 1/2" lettering on a contrasting background that read as follows: "NEGATIVE AIR MASTER SHUT OFF."
- D. Furnish all tools (e.g., scrapers, wire cutters, nylon brushes, utility knives, saws, rubber or plastic dust pans, squeegees, or shovels, etc.), reinforced rubber water hoses, and filter replacements for vacuums, and filtration units as necessary.
- E. Provide a calibrated incline or digital manometer to measure differential pressure between the inside and outside work areas. Record measurements a minimum of three times per work shift (beginning, middle and end) to ensure that a negative pressure of 0.02 inches of water is maintained.
- F. Furnish airless spray equipment with pumps capable of providing 500 pounds per square inch (psi) at the nozzle, and a flow rate of two gallons per minute (gpm) for spraying amended water and encapsulant.
- G. Furnish a sufficient supply of disposable mops, rags, scrub pads, HEPA vacuums with wand brush attachments, and sponges etc. for work area decontamination.
- H. Furnish a sufficient supply of respirator cartridges capable of filtering both asbestos and other fumes.
- I. Provide the necessary water filtration units, including filters to filter wastewater through a 0.5 micron final filter.

2.3 RESPIRATORY PROTECTION REQUIREMENTS

- A. Furnish all workers, foremen, superintendents, authorized visitors, and inspectors entering regulated work areas with personally issued respiratory equipment approved by NIOSH. Supply respirator filters and replacements as necessary.
- B. Determine the effectiveness of respiratory protection by evaluating job specific air monitoring data. Utilize appropriate respiratory protection based on air monitoring data to protect airborne exposures to workers, foremen, superintendents, authorized visitors, and inspectors.
- C. At a minimum, utilize full-face, powered air purifying respirator (PAPRs) equipped with HEPA cartridges during removal of friable materials, except for glovebag removal operations.

- D. At a minimum, utilize half-face, negative pressure air purifying respirators (APRs) equipped with HEPA cartridges during removal of non-friable materials, and work area clean up/detailing of friable materials.
- E. At a minimum, utilize half-face, negative pressure APRs equipped with dual HEPA and organic vapor cartridges during removal of materials using solvents.

2.4 PERSONAL PROTECTIVE EQUIPMENT

- A. Furnish all workers, foremen, superintendents, authorized visitors, and inspectors entering regulated work areas with disposable protective clothing consisting of full body coveralls, with head and foot coverings. Coveralls should be of adequate size and quality to accommodate movement without tearing and to prevent body contamination.
- B. Furnish eye protection (contact lenses shall not be worn and spectacle kits which fit each personal respirator shall be issued), gloves, rubber boots, safety shoes and hard hats as required by job conditions and Applicable Code Requirements. Rubber boots, safety shoes, and hard hats shall be approved in accordance with ANSI Z89.1 1969 and ANSI Z41.1 1967.
- C. Provide fall arrest equipment in accordance with CFR 1926.450.
- D. Leave reusable footwear, hard-hats, and eye protection devices in the contaminated equipment room until the end of the asbestos-related work or place into polyethylene bags, seal, and store in a locked area or storage bin.
- E. Discard and dispose of all disposable protective clothing as asbestos waste every time the wearer exits from the work space to the outside through the decontamination facilities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review the Contract Documents and perform a pre-construction site investigation to satisfy oneself of the existing conditions affecting the work including:
 - 1. All Applicable Code Requirements.
 - 2. Pre-existing damage and areas of repair that will not be the responsibility of the Contractor upon completion of abatement.
 - 3. The exact quantity of asbestos-containing/contaminated materials to be removed and those additional materials likely to be encountered during the course of work. All errors made in estimating, including costs and difficulties, are the sole responsibility of the Contractor, and shall not result in additional expense to the University.
 - 4. The physical considerations and conditions of both the material and structure. These considerations include any obstacles or obstruction encountered in accessing or removing the material.
 - 5. The amount and type of equipment needed to complete the job safely.
 - 6. The availability of utilities.
 - 7. The handling, storage, transportation, and disposal of the materials.

3.2 FIRE PROTECTION

- A. Remove and properly dispose of all combustible rubbish and debris, including properly bagged asbestos at the end of each working day.

- B. Utilize fire watch standing by with a 2A/60BC extinguisher during any work requiring open flame.
- C. Meet any and all recommendations for job site safety as may be required by the University's Representative.
- D. Maintain adequate fire extinguishers (Class ABC) ready for immediate use, distributed throughout the work area under abatement and in and about flammable temporary structures for the duration of the project. Provide a minimum of four (4) such approved fire extinguishers inside each work area, and others added at the rate of one (1) for every additional 1,000 square feet of work (or at a rate determined by Fire Safety Representative), in the work area, decontamination chamber, and adjacent to the work site.
 - 1. Exception: Where the total abatement containment area is less than 1,000 square feet, provide two (2) (Class ABC) extinguishers.
 - 2. Clearly demarcate all extinguisher locations with red tape.
 - 3. Ensure that on site personnel are aware of the location and proper use of all extinguishers and other fire/life safety equipment.
- E. Maintain a fire watch for a minimum of thirty (30) minutes after the cessation of each work shift.
 - 1. Maintain in place, active and unobstructed all existing exterior fire hydrants and standpipes. Obtain approval from University's Representative for any alteration to this equipment.
- F. Maintain fire/life safety information in the project log.
 - 1. Prepare a statement at the conclusion of each workday, signed by Contractor, confirming that a survey of the work site has been made and that any unsafe fire/life safety conditions have been rectified.
- G. Maintain a minimum of two (2) clearly marked emergency exits from each floor during the abatement. Exits from a containment area may be covered with plastic upon University's Representative's approval. Outline the covered exit with red duct type tape or fluorescent color spray paint, and provide a cutting device, also surrounded by red tape or paint, immediately adjacent to the exit.
- H. Obtain approval of University's Representative prior to temporarily or permanently modifying fire rated partitions, doors, and other fire cutoffs.
- I. Provide the following in containment areas greater than 1,000 square feet:
 - 1. Five (5) extra large "tyvek" type protective coveralls with head and foot coverings, at the entrance to the work area, in a clean, labeled container, for the exclusive use of emergency personnel.

3.3 WORK AREA ACCESS

- A. Restrict access to each work area to authorized, trained, and protected personnel. These may include the Contractor's employees, employees of Subcontractor's, the University's Representative, State and local inspectors, and any other designated individuals.
- B. Report entry into the work area by unauthorized individuals immediately to the University's Representative.

- C. Maintain a log book in a centralized location on the job site. Anyone who enters a regulated work area shall record his or her name, social security number, and affiliation.
- D. Access each work area through a single worker decontamination system per work area. Construct decontamination units located outside of the building that shall remain longer than one eight-hour shift of rigid materials (e.g., wood or metal studs and plywood sheathing). Provide locks to prevent unauthorized access.
- E. Block or lock all other means of access (doors, windows, hallways, non-designated elevators, non-designated fire exits, etc.) to prevent entry to or exit from the work area. Maintain access through the waste load-out (during the removal of containerized asbestos waste from the work area), and emergency exits in case of fire or accident.
- F. Provide all necessary means of accessing work areas including removal and reinstallation of doors, temporary ramps, platforms and stairways.
- G. Provide project site security in order to protect the site preparation and equipment.
- H. Work Hours:
 - 1. Unless otherwise approved in advance by the University's Representative, complete the work of this project as indicated in Section 01014 Contractor's Use of the Project Site.

3.4 DECONTAMINATION ENCLOSURE SYSTEMS

- A. Provide a three-stage decontamination unit attached to each work area. Each decontamination unit shall be constructed of rigid framing materials covered with 2 layers of opaque polyethylene sheeting. Construct three-stage decontamination units as follows:
 - 1. A clean room separated from the shower room by a weighted curtained doorway; 2) A shower room separated from the equipment room by a weighted curtained doorway; 3) An equipment/dirty room separated from the work area by a weighted curtained doorway or airlock. Provide a waste container for discarded coveralls, towels, and spent respirator cartridges in the equipment room.
 - 2. Provide a staging area around the decontamination facility of sufficient size for workers to change in and out of street clothes and protective clothing, as well as for lockers (for the storage of street clothes and worker/visitor possessions) uncontaminated disposable protective clothing, towels, respirators, and equipment. Provide opaque polyethylene sheeting or other suitable material to provide privacy.
 - 3. Provide clean shower facilities (portable metal showers or equal) with hot and cold water adjustable in the shower, and so arranged as to provide complete showering of workers and visitors as they exit from the contaminated area. Furnish an adequate supply of soap, shampoo, and towels in the shower at all times. Make provisions to prevent contaminated water run-off from the shower room (e.g., a tub).
 - 4. Provide one shower per 10 full-shift abatement workers or Subcontractor's personnel calculated on the basis of the largest shift.
 - 5. Filter all water utilized during this project and contaminated by asbestos. Utilize a filtering system containing a series of several filters (0.5 – 1.0 micron capability) with progressively smaller pore sizes to avoid rapid clogging of the filtration system by large particles. Discharge filtered wastewater to a sanitary sewer, or as otherwise acceptable to local regulatory discretion. Dispose of used filters as asbestos waste.

- B. Provide a two-stage waste decontamination unit attached to each work area. Each decontamination unit shall be constructed of rigid framing materials covered with 2 layers of opaque polyethylene sheeting. Construct two-stage decontamination units as follows:
1. A clean room separated from the wash room by a weighted curtained doorway.
 2. A shower room separated from work area by a weighted curtained doorway or airlock.
 3. Equip the wash room with the facilities (e.g., water hose or airless sprayer) to wash and wipe the outside of the waste bags or containers prior to removing them from the work area for transportation to the landfill. Make provisions to prevent any contaminated water run-off from the wash room by providing a child's swimming pool or equivalent water collection device.

3.5 WORK PLACE ENTRY AND EXIT PROCEDURES

- A. Post the following information in the staging area outside the decontamination facility:
1. Telephone/cellular phone numbers/pager numbers for local hospital, location of hospital and/or emergency personnel, local fire department, University's Representative, and Contractor's Representatives.
 2. Copies of notifications to regulatory agencies as required herein.
 3. Copies of Contractor's respiratory protection program and injury and illness protection program.
 4. Copies of the Contractor's emergency procedures as specified herein.
 5. Employee daily sign-in/out log.
 6. Employee/visitor work area entry/exit log.
 7. Cal/OSHA required postings.
 8. Logs documenting filter changes on HEPA vacuums, negative air filter units, and shower filters.
 9. SCAQMD HEPA vacuum and air filtration unit permits.
 10. Initial air monitoring results for HEPA negative air filter unit exhaust as required by SCAQMD Rule 1403 and permit requirements. Collect air samples on the first day of abatement activities.
 11. All personnel air sampling results in accordance with 29 CFR §1926.1101.
- B. Personnel Entry and Exit
1. Furnish all personnel and authorized visitors throughout the abatement process with the specified protective clothing and gear. Ensure that all personnel entering and leaving the work area abide by the following procedures:
 - a. Enter the abatement work area through the worker decontamination facility.
 - b. Ensure that all personnel, before entering the work area, have read and are familiar with all posted Applicable Code Requirements, personal protection requirements (including work place entry and exit procedures), and emergency procedures. Furnish a sign off sheet to acknowledge that these have been reviewed and understood by all personnel prior to entry.
 - c. Remove all street clothes and appropriately don personal protective equipment and respiratory protection.
 - d. Wearing designated personal protective equipment, workers and visitors proceed to the work area.
 - e. No smoking, eating, drinking, chewing of gum or tobacco, application of cosmetics, or wearing of jewelry while inside the work area.
 - f. Removal of gross contamination from the outside of respirators and protective clothing prior to leaving the work area by brushing and/or HEPA-vacuuming procedures. Provide a walk-off pan (e.g., small children swimming pool filled

- with water) for workers/visitors to clean off foot coverings prior to leaving the work area and entering the dirty room.
- g. Proceed to the dirty room of the decontamination enclosure and remove protective coveralls. Continue to wear respirators until in the shower.
- h. Store reusable, contaminated foot wear and other contaminated equipment in sealed containers in a designated “contaminated” area when not in use in the work area.
- i. Shower using soap and shampoo to remove asbestos contamination. Rinse respirator face pieces and parts that are waterproof upon entering the shower. Wet wipe non-waterproof items such as respirator motors or filters.
- j. After showering/washing and drying off, proceed to the clean room and don clean disposable clothing for re-entry into the work area or street clothes.

C. Waste Load-Out Procedures

1. Ensure that all waste leaving the work area is done in accordance with the following procedures:
 - a. Transport containerized asbestos contaminated waste out of the work area through the waste decontamination facility.
 - b. Utilize two teams of workers, an "inside" team and an "outside" team for waste load-out procedures.
 - c. The inside team, wearing appropriate protective clothing and respirators:
 - (1) Evacuates the air from the bags using a HEPA vacuum, seals bags using duct tape, and then passes bags through to the waste decontamination facility wash room.
 - (2) Cleans the outside, including the bottoms, of properly labeled containers (bags, drums, or wrapped components) using water hoses or airless sprayers and wet wiping techniques, and then transports the containers into the waste decontamination facility clean room.
 - d. The outside team, wearing protective clothing and respirators:
 - (1) Places bags in clean, labeled, 6 mil polyethylene bags, seals the bags using duct tape and the “Gooseneck” seal technique, and then removes the bags from the waste decontamination facility clean room.
 - (2) Encloses the wrapped components in clean, labeled, 6 mil polyethylene sheeting and then removes them from the waste decontamination facility clean room.
 - (3) Removes cleaned drums from the waste decontamination facility clean room.
 - e. Transport the waste to the waste container (s) via wheelbarrow-type carts lined with polyethylene sheeting and covered with a secondary layer of sheeting when full. Transport waste to the waste container along unoccupied routes pre-approved by University’s Representative, and as indicated in Contractor’s submittals.

3.6 EXPOSURE CONTROLS

- A. Provide the following exposure controls for the work areas:
1. The means to provide supply air to and exhaust air from the work area to maintain negative pressure. Operate on a 24-hour basis throughout asbestos-related work until final air clearance is achieved.
 2. Maintain a static negative air pressure of 0.02 inches (minimum) water at all times in the work area during abatement to ensure that contaminated air in the work area does not migrate to uncontaminated areas.

3. Provide and initiate operation of HEPA-filtered ventilation units as needed to furnish an air change in the work area a minimum of every 15 minutes. Provide a sufficient number of supply and exhaust units to create a stream of air away from the faces of the workers, and in such a way as to not damage or compromise the integrity of the plastic isolation barriers.
4. Maintain at all times, at minimum, two HEPA-filtered ventilation units as back-ups in case of failure of any operating units or as means to maintain static negative air pressure.
5. Provide ventilation units at the opposite end of the decontamination facility in order provide air flow across the work area.
6. Provide an on-site static pressure strip-recording manometer with an audible alarm or fluid incline manometer for all work areas. Submit tape chart recordings or measurements daily to the University's Representative.
7. Seal all openings made in the enclosure system made to accommodate ventilation units airtight with tape and/or caulking as needed.
8. If more than one unit is installed, turn the units on one at a time, checking the integrity of wall barriers for secure attachment and need for additional reinforcement.
9. On electric power failure, stop all work immediately, do not resume until power is restored and exhaust units are operating again. On extended power failure, (longer than 1 hour), seal the decontamination facilities air tight after the evacuation of personnel from the work area.
10. Exhaust HEPA filtered ventilation units to the outside of the building no closer than fifty (50) feet to any building HVAC supply vents or other air system intakes, or entrances/exits of occupied areas.

3.7 MAINTENANCE OF WORK PLACE BARRIERS AND WORKER DECONTAMINATION ENCLOSURE SYSTEMS

- A. Inspect all polyethylene barriers inside the work area, in the worker decontamination enclosure system, and at partitions constructed to isolate the work area from occupied areas, before the start of each shift and at least twice daily during the shift. Document inspections and observations in the daily project log.
- B. Repair damage and defects in the enclosure system immediately upon discovery.
- C. Utilized air current (smoke) tubes to test the effectiveness of the work area barriers, the worker and equipment decontamination systems with the negative pressure ventilation units in operation before abatement work at least once for each shift, or when requested by the University's Representative. Document results and observations in the project log book.
- D. If visible material is observed outside of the work area or if damage occurs to barriers, immediately stop work, repair barriers, and clean up debris/residue using appropriate HEPA vacuuming and wet wiping procedures.
- E. If air samples collected outside of the work area during abatement activities indicate airborne fiber concentrations greater than 0.010 f/cc or pre-measured background levels (whichever is higher), stop work immediately for inspection and repair of barriers. Cleanup of surfaces outside of the work area, using HEPA vacuums or wet wiping techniques, as necessary.

3.8 INITIAL CLEANING

- A. Pre-clean all movable objects in the work area using HEPA vacuuming or wet-cleaning methods as necessary to remove all visible dust and debris. After cleaning, remove objects from the work area and dispose or store in an uncontaminated location as approved by University's Representative.
- B. Pre-clean all fixed objects (e.g., walls, floors, etc.) in the work area using HEPA vacuuming or wet-cleaning methods as necessary to remove all visible dust and debris. After cleaning, protect with polyethylene sheeting as specified herein.
- C. Dispose of all suspect debris and contaminated filters, mop heads, cloths, etc. used to perform pre-cleaning work in sealed, leak-proof containers.

3.9 WORK AREA PREPARATION

- A. General:
 - 1. Warning Signs:
 - a. Post caution signs meeting the specifications of 29 CFR §1926.1101 K(2) at appropriate approaches to the work area where airborne concentrations of asbestos may exceed ambient background levels. Post signs a distance sufficiently far enough away from the work area so as to permit an employee or visitor to read the sign and take the necessary protective measures to avoid exposure. Post additional signs following construction of work place enclosure barriers at all entrances and exits to the work area.
 - 2. Electrical Equipment:
 - a. Use methods, as necessary, to protect stationary electrical equipment including panel boards, and transformers, scheduled to remain energized.
 - b. Obtain University's Representative's approval prior to any utility shutdown in accordance with Section 01500 Construction Facilities and Temporary Controls.
 - 3. Temporary electrical service:
 - a. Provide and maintain all necessary temporary ground fault electrical power service, distribution, equipment, connections, etc., as necessary for the Work. Before final acceptance, remove all temporary equipment and connections installed in a manner approved by University's Representative.
 - b. Coordinate with the University's Representative, the shut down, lock out and isolation of electrical systems. Label electrical conduits or cabling running through the work area that shall remain in operation during the abatement.
 - c. Make temporary service connections to the existing electrical distribution system at a point which shall be made available by the University's Representative.
 - (1) Provide spider boxes or similar devices to furnish power from the panelboard to the work area for small tools and lighting. Power for larger equipment and lighting for use inside the work area during abatement may be taken directly from panelboards as approved by University's Representative.
 - (2) Do not allow the load connected to any circuit to exceed 25% of the feeder capacity as labeled on the panel board.
 - (3) Do not disturb cables and conductors which may prevent closing of fire-labeled doors.
 - (4) Provide ground fault interrupter outlets in order to allow for temporary electric power hook ups.

- (5) Furnish an electrician or electrical Subcontractor with a current State of California Contractor's C-10 (Electrical - General) license in order to accomplish required electrical hook ups and equipment installations.
 - (6) Comply with NEMA, MECA and UL standards and CAL/OSHA requirements.
 4. Temporary Lighting:
 - a. Provide "string type" general service incandescent lighting with guarded cages and portable plug in task lighting of sufficient wattage throughout the work area to supply a 20 foot candle minimum light level.
 - b. Temporary lighting may be used in combination with natural lighting to achieve minimum light level.
 5. HVAC Systems:
 - a. Coordinate with the University's Representative, the shut down, lock out and isolation of heating, cooling, and ventilating air systems. Maintain shutdown throughout the abatement to prevent contamination and fiber dispersal to other areas of the structure and outside the building.
 - b. Seal all intake and exhaust vents leading from the work area with two layers of 6-mil polyethylene sheeting and duct tape. Seal seams in HVAC components that pass through the work area prior to covering with poly sheeting.
- B. Full-Containments (Including removal of flooring materials using mechanical means): Utilize full containment methodologies for the removal of regulated asbestos-containing materials (RACM) and friable materials:
 1. Remove non-fixed items from the work area and dispose or store in an uncontaminated location as approved by the University's Representative.
 2. Remove and dispose of baseboards, carpeting, tack strips, floor monuments, hardware, partitions, ceilings and associated support structures, and other items etc. as required to access and remove ACMs.
 3. Remove lighting fixtures, and remove light tubes and (PCBs) polychlorinated biphenyl light ballasts and dispose.
 4. Provide pre-cut plywood manifolds in windows or louvers at point (s) where HEPA exhaust ducts exit the building. Paint the exterior of the plywood beige. Caulk and seal the plywood manifolds airtight.
 5. Provide ladders, scaffolds, temporary stairways to access the work areas and fall protection in accordance with 29 CFR §1926.050, and 450-454.
 6. Provide critical barriers of, at minimum, two layers of 6-mil polyethylene sheeting individually secured with spray adhesive (except for where masonry surfaces exist), and then taped over all openings leading from the work area including windows, doors, diffusers, etc.
 7. Prior to the installation of polyethylene critical barriers at openings that lead to the exterior of the building, and that shall not be used as emergency egress, provide minimum ½" thickness plywood material and rigid framing.
 8. Identify and seal with firestop, spray foam, or equal, all floor/ceiling penetrations, including drains, cracks, expansion joints, cable runs, conduits, pipes runs or ducts.
 9. Connect worker/waste decontamination facilities and HEPA filtration devices as per Paragraphs 3.4 and 3.6 above.
 10. Cover all remaining non-removable items and surfaces in the work area with two layers of 6-mil polyethylene sheeting taped securely.
 11. Demarcate emergency exits and path of travel to emergency exits with bright colored arrows or spray paint, located approximately 30" above the floor.
 12. Provide sufficient view ports to allow persons outside the work area to view all parts of the work area.

13. Cover walls, floors, and ceilings in the work area with two layers of 6-mil polyethylene sheeting. Secure wall sheeting so as to prevent it from falling away from walls. This may require additional support/attachments when negative pressure ventilation systems are turned on. Tightly seal polyethylene sheeting at both the top and bottom of wall.
 14. Provide a 6-mil drop cloth beneath areas of gross removal of friable materials.
 15. Tape each layer of polyethylene sheeting directly to the wall. Do not tape to each other.
 16. Overlap wall and floor sheeting by at least 12 inches beyond the wall/floor joint.
 17. Size plastic to minimize seams. Stagger successive layers of sheeting to reduce the potential for water to penetrate beyond the floor sheeting. Do not locate any seams at wall/floor joints.
 18. Separate seams by at least a distance of six feet. Overlap all seams by a minimum of 12 inches, and secure by first applying spray adhesive and then firmly securing with tape.
 19. After installation and operation of critical barriers, decontamination facilities, and HEPA filtration devices, and wall and floor coverings, request, receive, and pass a pre-abatement visual inspection as arranged by the University's Representative prior to initiation of abatement activities. Operate HEPA filtration devices for at minimum two hours prior to requesting a pre-abatement visual inspection.
- C. Non-Friable Vinyl Floor Tile/Sheeting and Associated Mastic Removal Areas (Including removal of flooring materials using non-mechanical means):
1. Remove non-fixed items from the work area and dispose or store in an uncontaminated location as approved by the University's Representative.
 2. Remove and dispose of baseboards, carpeting, tack strips, floor monuments, hardware, wall partitions, ceilings and associated support structures, and other items etc. as required to access and remove pipe/fitting insulation, floor tiles, mastics, and leveling compounds.
 3. Provide pre-cut plywood manifolds in windows or louvers at point (s) where HEPA exhaust ducts exit the building. Paint the exterior of the plywood beige. Caulk and seal the plywood manifolds airtight.
 4. Provide ladders, scaffolds, temporary stairways to access the work areas and fall protection in accordance with 29 CFR §1926.050, and 450-454.
 5. Provide critical barriers of, at minimum, two layers of 6-mil polyethylene sheeting individually secured with spray adhesive (except for where masonry surfaces exist), and then taped over all openings leading from the work area including windows, doors, diffusers, etc.
 6. Prior to the installation of polyethylene critical barriers at openings that lead to the exterior of the building, and that shall not be used as emergency egress, provide minimum ½" thickness plywood material and rigid framing.
 7. Identify and seal with firestop, spray foam, or equal, all floor/ceiling penetrations, including drains, cracks, expansion joints, cable runs, conduits, pipes runs or ducts.
 8. Connect worker/waste decontamination facilities and HEPA filtration devices as per Paragraphs 3.4 and 3.6 above.
 9. Demarcate emergency exits and path of travel to emergency exits with bright colored arrows or spray paint, located approximately 30" above the floor.
 10. Cover all remaining non-removable items in the work area with at two layers of 6-mil polyethylene sheeting taped securely.
 11. Cover walls in the work area with one layer of 6-mil polyethylene sheeting "splash guards" a minimum of 72" in height, from the floor up the wall. Secure wall sheeting so as to prevent it from falling away from walls. This may require additional

- support/attachments when negative pressure ventilation systems are turned on. Tightly seal polyethylene sheeting at both the top and bottom of wall.
12. Size plastic to minimize seams. Separate seams by at least a distance of six feet. Overlap all seams by a minimum of 12 inches, and secure by first applying spray adhesive and then firmly securing with tape.
 13. After installation and operation of critical barriers, decontamination facilities, and HEPA filtration devices, and wall coverings, request, receive, and pass a pre-abatement visual inspection as arranged by the University's Representative prior to initiation of removal activities. Operate HEPA filtration devices for at minimum two hours prior to requesting a pre-abatement visual inspection.
- D. Glovebag Removal Areas (Removal of Pipe/Fitting Insulation):
1. Remove non-fixed items from the work area and dispose or store in an uncontaminated location as approved by the University's Representative.
 2. Provide pre-cut plywood manifolds in windows or louvers at point (s) where HEPA exhaust ducts exit the building. Paint the exterior of the plywood beige. Caulk and seal the plywood manifolds airtight.
 3. Provide ladders, scaffolds, temporary stairways to access the work areas and fall protection in accordance with 29 CFR §1926.050, and 450-454.
 4. Provide critical barriers of, at minimum, two layers of 6-mil polyethylene sheeting individually secured with spray adhesive (except for where masonry surfaces exist), and then taped over all openings leading from the work area including windows, doors, diffusers, etc.
 5. Connect worker/waste decontamination facilities and HEPA filtration devices as per Paragraphs 3.4 and 3.6 above.
 6. Provide a 6-mil drop cloth shall beneath areas of glove bag removal.
 7. Demarcate emergency exits and path of travel to emergency exits with bright colored arrows or spray paint, located approximately 30" above the floor.
 8. Provide glovebags so that they completely cover the pipe/fitting circumference.
 9. Smoke test glovebags for leaks prior to removal. Repair any leaks found.
 10. Provide a HEPA vacuum to evacuate air from glovebags prior to removing bags for the pipe/fitting.
 11. Provide "hudson" type garden sprayers to apply amended water during glovebag removal.
 12. After installation and operation of critical barriers, decontamination facilities, and pass a pre-abatement visual inspection as arranged by the University's Representative prior to initiation of abatement activities. Operate HEPA filtration devices for at minimum two hours prior to requesting a pre-abatement visual inspection.
- E. Spot Abatement for Vinyl Floor Tile/Sheeting and Associate Mastic, Pipe Insulation/Debris and Spray-Applied Fireproofing (Contractor Assist) for Data Cable Supports/Core Drilling/Equipment Fasteners/"J" Hooks:
1. Perform spot abatement and fastener drilling/installation using workers, and "competent person"/supervisors who have been trained per 29 CFR §1926.1101 and 8 CCR §1529, in addition to AHERA Worker or Supervision/Contractor Certification.
 2. Construct mini-containments for spot abatements not located within containment areas.
 3. Constructed mini-containments or moveable containments with, at minimum, one layer of 6-mil polyethylene sheeting supported by scaffolding and bailing wire, PVC tubing, or other rigid material.
 4. Secure walls and ceilings to one another using tape and spray-adhesives. Mini-containments shall be rendered air-tight to the extent feasible.

5. Construct remote personnel decontamination systems as described in 3.04. Post asbestos warning signs as per 3.08(A) on the outside of the flaps to each work area.
6. Provide and initiate local HEPA-equipped air filtration devices using HEPA vacuum.
7. After installation and operation of critical barriers, decontamination enclosure system, and HEPA filtration devices, request, receive, and pass a visual inspection as arranged by the University's Representative prior to initiation of abatement activities.

3.10 REMOVAL OF ASBESTOS-CONTAINING MATERIALS/ASBESTOS-CONTAINING CONSTRUCTION MATERIALS

- A. Full-Containments (Including removal of flooring materials using mechanical means):
 1. Properly prepare work area as described in Paragraph 3.9 herein.
 2. Wet all asbestos-containing material/asbestos-containing construction material with an amended water solution. Utilize equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Saturate the material to the substrate; however, do not allow excessive water to accumulate in the work area. Keep all removed material wet until it can be containerized for disposal.
 3. Maintain high humidity in the work area by regular misting until all visible material has been cleaned up.
 4. Once saturated, remove all asbestos-containing materials/asbestos-containing construction materials. Remove in manageable sections to substrate using hand-held tools such as scrapers, wire cutters, abrasive pads, sponges, and rags.
 5. Utilize mechanical means (e.g., nylon bushes, sponges, and pads, rags, pole/hand razor scrapers, and/or mechanical rotary buffers with abrasive pads to remove vinyl floor tiles, mastics, leveling compounds, residues).
 6. Promptly bag all removed materials. Periodically spray the work area to maintain in a wet condition.
 7. Seal containerized waste (6-mil polyethylene bags) when full. Do not overfill bags since wet material can be exceedingly heavy. Securely seal containers to prevent accidental opening and leakage (i.e., tying tops of bags in an overhand knot or by taping in "gooseneck" fashion, never with wire or cord).
 8. Package sharp-edge asbestos waste components (e.g., nails, screws, metal lath, tin sheeting, wires, vinyl floor tiles, etc.), that will tear polyethylene bags in burlap, reinforced polyethylene bags, or drums for disposal.
 9. Do not drop or throw material that is removed and bagged to ground level. Utilize a forklift or equal to lower waste to ground level.
 10. Detail clean all surfaces to remain in the work area including utility lines, hangars, conduit, junction boxes, and sprinkler lines.
 11. Clean up work areas as described in Paragraphs 3.11 and 3.12 herein.
- B. Non-Friable Vinyl Floor Tile/Sheeting and Associated Mastic Removal Areas (Including removal of flooring materials using non-mechanical means):
 1. Properly prepare work areas as described in Paragraph 3.9 herein.
 2. Wet all asbestos-containing material/asbestos-containing construction material with an amended water solution. Utilize equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Saturate the material to the substrate; however, do not allow excessive water to accumulate in the work area. Keep all removed material wet until it can be containerized for disposal.
 3. Maintain high humidity in the work area by regular misting until all visible material has been cleaned up.

4. Promptly bag all removed materials. Periodically spray work area to maintain in a wet condition.
 5. Seal containerized waste (6-mil polyethylene bags) when full. Do not overfill bags since wet material can be exceedingly heavy. Securely seal containers to prevent accidental opening and leakage (i.e., tying tops of bags in an overhand knot or by taping in gooseneck fashion, never with wire or cord).
 6. Package floor tiles that will tear polyethylene bags in burlap, reinforced polyethylene bags, or drums for disposal.
 7. Do not drop or throw material that is removed and bagged to ground level. Utilize a forklift or equal to lower waste to ground level.
 8. Wrap wall cement board/laboratory tables in two layers of 6-mil polyethylene sheeting sealed with duct tape. Apply OSHA warning labels
 9. Use manual means (e.g., pole scrapers) to remove all vinyl floor tiles. Promptly bag removed tiles.
 10. Apply solvent with a garden-type sprayer. Utilize non-mechanical means (e.g., nylon brushes, sponges, pads, rags, pole/hand razor scrapers) to remove the mastic. Apply solvents in strict accordance with the manufacturer's instructions and in a quantity sufficient to liquefy the mastic, being careful not to allow the solvent or liquefied mastic to pool or run off. Do not apply or allow the solvent to accumulate adjacent to fabric finishes, drywall, or wood materials.
 11. Remove floor tile, mastic, residue and leveling compounds down to the bare slab. Remove mastic to the approval of the University's Representative.
 12. Detail clean abated surfaces using HEPA-vacuuming and wet-wiping methods. Dry sweeping is not allowed.
 13. Wet mop floors with Pine Sol™, Tide® or equal followed by water where emulsifying solvent was used.
 14. Do not apply a post abatement lock down encapsulant to abated surfaces so as not to interfere with adhesion of replacement flooring materials.
 15. Clean up work areas as described in Paragraph 3.11 and 3.12 herein.
- C. Glovebag Removal Areas:
1. Properly prepare work areas as described in Paragraph 3.9 herein.
 2. Cut TSI from the substrate in manageable sections. Wet materials can become exceedingly heavy; do not overfill glovebags.
 3. Clean substrate using nylon brushes/scrub pads as needed.
 4. Spray-apply a post-abatement lock down encapsulant to the abated pipes.
 5. Clean and rinse tools inside the glovebag. Place tools in the reversed arm of the glovebag and seal.
 6. Evacuate the air from the glovebag using a HEPA-filtered vacuum cleaner prior to tying off and removing the glovebag from the pipe. Immediately place the removed glovebag inside a secondary disposal bag.
 7. Clean up work areas as per Paragraph 3.11 and 3.12 herein.
- D. Spot Abatement for Vinyl Floor Tile/Sheeting and Associate Mastic, Pipe Insulation/Debris and Spray-Applied Fireproofing (Contractor Assist) for Data Cable Supports/Core Drilling/Equipment Fasteners/"J" Hooks:
1. Properly prepare work areas as described in Paragraph 3.9 herein.
 2. In lieu of the construction and utilization of "mini-containments" at each fastener drilling location, power drills equipped with a HEPA dust collecting shroud connected to a HEPA vacuum or other similar localized dust collection system or the "wet sponge" method (place wet sponge over hole to be drilled and drill through the

sponge) may be used alternatively or in conjunction with mini-containments and removal of vinyl floor tile and associated mastic.

3. Wet all asbestos-containing material/asbestos-containing construction material with an amended water solution. Utilize equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Saturate the material to the substrate; however, do not allow excessive water to accumulate in the work area. Keep all removed material wet until it can be containerized for disposal. Use manual means (e.g., hand scrapers) to remove materials. Promptly bag removed tiles.
4. Apply solvent with a garden-type sprayer. Utilize non-mechanical means (e.g., nylon brushes, sponges, pads, rags, pole/hand razor scrapers) to remove the mastic. Apply solvents in strict accordance with the manufacturer's instructions and in a quantity sufficient to liquefy the mastic, being careful not to allow the solvent or liquefied mastic to pool or run off. Do not apply or allow the solvent to accumulate adjacent to fabric finishes, drywall, or wood materials.
5. Remove floor tile, mastic, residue and leveling compounds down to the bare slab. Remove mastic to the approval of the University's Representative.
6. Detail clean abated surfaces using HEPA-vacuuming and wet-wiping methods. Dry sweeping is not allowed.
7. Wet mop floors with Pine Sol™, Tide® or equal followed by water where emulsifying solvent was used.
8. Do not apply a post abatement lock down encapsulant to abated surfaces so as not to interfere with adhesion of replacement flooring materials.
9. Clean up work areas as described in Paragraph 3.11 and 3.12 herein.

3.11 CLEAN-UP PROCEDURES – GENERAL

- A. Promptly clean up visible accumulations of loose asbestos-containing or contaminated materials, or keep moist until bagged.
- B. Promptly clean up spills or pools of emulsifying solvent and/or liquefied mastic with an absorbent material.
- C. Collect asbestos-containing or contaminated materials utilizing rubber or plastic dust pans, shovels, and squeegees or HEPA vacuums.
- D. Do not use metal shovels or brooms within the work area.
- E. Clean up visible accumulations of asbestos-containing or contaminated materials from all surfaces, and spills or pools of emulsifying solvent in the work area on a daily basis.
- F. Wet wipe all surfaces in the work area using rags, mops, sponges, and other equipment as needed to remove all visible residue.
- G. Detail clean surfaces from where asbestos-containing materials/asbestos-containing construction materials have been removed using nylon brushes/scrub pads, sponges, and rags and other equipment as needed to remove all visible residue.

3.12 FINAL CLEANING

- A. Remove all containerized waste from the work area and decontamination facilities.

- B. Remove all tools and equipment (except equipment needed to complete final cleanings, air filtration units, critical barriers, polyethylene sheeting) from the work area and properly decontaminate in the decontamination facility.
- C. Non-Friable Materials Removal Areas:
 - 1. Remove the plastic sheeting “splash guards” from walls. Maintain in place and operation critical barriers, and, air filtration devices and decontamination facilities.
 - 2. Detail clean all surfaces in the work area.
 - 3. After cleaning the work area, provide a period of time to allow fibers to settle.
- D. Full Containment Work Areas:
 - 1. Remove the cleaned secondary (outer) layer of plastic sheeting from walls and floors. Maintain in place and operation critical barriers, primary (inner) layer of polyethylene sheeting, air filtration devices and decontamination facilities.
 - 2. After cleaning the work area, provide a period of time to allow fibers to settle.
 - 3. Remove secondary (inner) layer of polyethylene sheeting and HEPA vacuum and wet clean all surfaces in the work area again.
- E. Request and pass a pre-clearance (pre-encapsulation) visual inspection as arranged by the University’s Representative.
- F. Re-clean work area, at no additional cost, as requested or as necessary to remove all visible residue and debris. Repeat cleaning cycles as described above. Request and pass pre-clearance visual inspection (s).
- G. Apply Lock-down encapsulant to all surfaces (except floors) and polyethylene sheeting in the work area.
- H. Pre-clearance visual inspection (s) and clearance air monitoring shall be arranged by the University’s Representative. Refer to Paragraph 3.14 herein.
- I. After passing pre-clearance inspections and final clearance air monitoring, remove all remaining plastic sheeting, critical barriers, air filtration equipment, and breakdown decontamination facilities.
- J. Remove cleaned layers of plastic from walls and floors and dispose as asbestos contaminated waste.
- K. Inspect the work area with University’s Representative, and clean-up any visible debris or solvent that may still be present.
- L. Remove all waste, materials, and equipment used to complete the work.
- M. Request and pass a post teardown visual inspection from the as arranged by University’s Representative.
- N. Repair damages caused during abatement activities (e.g., paint peeled by duct tape removal, nail holes, water damage, broken glass, etc.), at no additional cost to the University. Restore the work area and auxiliary areas used to perform the abatement work to conditions equal to pre-abatement conditions.

3.13 INSPECTION SEQUENCE

- A. After properly preparing the work area, request, receive, and pass a pre-abatement visual inspection as arranged by the University's Representative prior to initiation of removal activities. Do not commence abatement work until after passing the pre-abatement visual inspection and the University's Representative has approved the following:
 - 1. Work area enclosure systems have been constructed and inspected.
 - 2. HEPA air filtration devices are functioning adequately.
 - 3. All pre-abatement submissions, notifications, postings and permits have been provided and are satisfactory to University's Representative.
 - 4. All labor, materials and equipment for abatement, cleanup and disposal are on hand.
 - 5. All worker training and certification is completed.
- B. In conjunction with Contractor's daily inspections, the University's Representative shall arrange for the performance of daily inspections and air monitoring. Immediately, without cost to University, correct deficiencies identified during daily inspections and air monitoring and make all necessary modifications to the satisfaction of the University's Representative.
- C. After removal of all asbestos-containing materials/asbestos-containing construction materials, initiate final cleaning procedures as described in Paragraph 3.12 herein. After completion of final cleaning (s), request, receive, and pass pre-clearance inspection (s), final clearance air monitoring, and post-teardown inspection (s) as described in Paragraph 3.12 and Paragraph 3.14 herein.

3.14 AIR MONITORING

- A. University Furnished Air Monitoring
 - 1. The University shall furnish a trained and State-Certified Site Surveillance Technician under the direction of a State-Certified Asbestos Consultant to perform inspection, and air monitoring services to monitor the Contractor's compliance with the specifications, Applicable Code Requirements, University policies, and standard industry work practices.
 - 2. The University shall arrange for the performance of background (baseline) air monitoring to determine pre-existing baseline fiber levels prior to abatement. Ambient baseline fiber levels are presumed to be less than or equal to ($\leq$) 0.010 f/cc in the event background air sampling is not performed.
 - 3. Air monitoring shall be performed daily by as arranged by the University during preparation, removal, and cleaning. The monitoring shall occur both inside and outside the work area, so as to accurately assess the airborne fiber levels.
 - 4. Final air clearance methods shall be utilized using NIOSH 7400 Method of analysis (Phase Contrast Microscopy). Final air clearance criteria shall be $\leq$ 0.010 f/cc for each inside sample. Air samples shall be collected from each regulated area after asbestos abatement, and prior to release for re-occupancy by untrained and unequipped personnel.
 - 5. University reserves that right to utilize aggressive final air clearance methods 40 CFR Part 763 (Transmission Electron Microscopy).
 - 6. At the discretion of the University's Representative, in progress, passive (non-aggressive) (a.k.a., process samples) may be utilized to clear vinyl floor tile and mastic, and floor carpet mastic work areas provided that airborne fiber levels remain $\leq$ 0.010 f/cc throughout the duration of abatement activities.
 - 7. At no cost to the University, Contractor shall reclean work areas as described herein that do not meet the clearance criteria established herein.
 - 8. Contractor shall be responsible for subsequent sampling (labor costs) and analytical costs due to initial clearance failures.

- B. Contractor Provided Air Monitoring
 - 1. Conduct Phase Contrast Microscopy air monitoring of the exhaust from each negative air filtration unit used on the project during the first day of removal and after each HEPA filter replacement in accordance with SCAQMD requirements.
 - 2. Conduct personal sampling in accordance with 8 CCR §1529 and 29 CFR §1926.1011.
 - 3. During the first full four (4) shifts of removal activities, furnish a trained and State-Certified Site Surveillance Technician under the direction of a State-Certified Asbestos Consultant or a State-Certified Asbestos Consultant to perform personal sampling services.
 - 4. Conduct personal air monitoring daily throughout the duration of asbestos abatement activities to determine accurately the airborne concentrations of asbestos to which workers may be exposed, in accordance with the 29 CFR §1926.1101 and 8 CCR §1529.
 - 5. Take samples in such frequency and pattern as to represent, with reasonable accuracy the level of exposure to all workers. The recommended percentage of workers is 25%, at a minimum.
 - 6. Perform analysis in accordance with the OSHA Reference Method by an analyst who has "NIOSH 582" or equivalent certification and is a successful participant in the AIHA PAT program or equivalent.
 - 7. Post monitoring results and appropriate laboratory analysis work in the staging area, with a copy submitted to University's Representative within twenty-four hours from the time the samples were collected.

3.15 STOP WORK ORDER

- A. University's Representative shall have the right to issue a Stop Work Order whenever Contractor's work engineering controls, or air monitoring results are not in accordance with Applicable Code Requirements, contractual restrictions, or the abatement specifications. All costs resulting from the Stop Work Order shall be at Contractor's expense. Refer to General Conditions Article 2.3.1.
- B. The Stop Work Order shall first be given verbally to Contractor by the University's Representative, at which point all work shall cease. This will be immediately followed by a written notification to stop work. If the situation is not corrected to University's Representative's satisfaction within forty-eight (48) hours, Contractor shall be considered to be in breach of the Contract and shall be subject to termination in accordance with General Conditions Article 13.2.

END OF SECTION

UCLA
ASBESTOS WORK DESCRIPTION

Project Name: _____

Project #: _____ Order #: _____ Completion Date: _____

Base Contract Amount: \$ _____ Change Order #: _____ Change Order Amount: \$ _____

Contractor Name: _____

Monitoring Consultant: _____

Building Name: _____

Location
Within Building: _____

Contractor's description of work performed and methods used: _____

Check all that apply:

Scaffolding ☐

Full Containment ☐

Glove Bag ☐

Mini Enclosure ☐

Other Methods Employed: _____

COMPLETE ALL INFORMATION ON NEXT PAGE

UCLA

Location of Work	Type of Work (state specific dollar amount)				Type and Amount of Material (list amount in square or lineal feet)		
	Encapsulation/ Repair	Removal	Replacement	Incidental Removal	Surface Treatment	Insulation	Misc.
Floors							
Roof							
Walls							
Ceilings							
Pipes							
Boilers							
Tanks							
Shaft/ Plenum/ Ducts							
Other							

SECTION 02081 -LEAD REMOVAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes the proper set-up, removal, decontamination, and disposal of the following known and presumed lead (LP) and lead-containing paint (LCP) on building components:
- | | |
|--|-----------------|
| 1. Wall/Ceiling Sheeting (In walls/Ceilings) | 350 Square Feet |
| 2. Doors/Frames | 5 Each |
| 3. Walls/Ceilings (Spot Removal) VOIP/Data Jack Locations | 900 Each |
| 4. Walls/Ceilings (Spot Removal) Cable Sleeve/Coring Locations | 250 Each |
- B. Lead Demolition Activities: Includes the demolition of all LP and LCP not specified for removal above.
1. Demolition of LCP and painted building components.
 2. Removal of LP.
 3. Welding, torch cutting, or grinding and any other demolition activity (e.g., “Trigger Tasks” as defined by 8 CCR §1532.1).
- C. Lead Construction Activities: Impacts to all LP and LCP not specified for removal above.
1. Drilling to install dowels, hangers, straps, tie-ins, use of equipment fasteners to fasten equipment, finishes or fixtures, and any other methods or equipment that shall impact LP/components.
 2. Preparation for the re-painting of finishes or fixtures, and any other LP and LCP/components impacted by the work.
 3. Welding, torch cutting or grinding and any other construction activity (e.g., “Trigger Tasks” as defined by 8 CCR §1532.1).
- D. All quantities listed above are approximate, and may not represent actual conditions. Verify actual quantities and sizes by field observation, review of as built drawings or other suitable method.

1.2 RELATED WORK

- A. Section 01014: Contractor’s Use of the Project Site
- B. Section 01060: Regulatory Requirements
- C. Section 01340: Shop Drawings, Product Data and Samples
- D. Section 01500: Construction Facilities and Temporary Controls
- E. Section 01510: Temporary Utilities
- F. Section 01630: Product Options and Substitutions
- G. Section 02080: Asbestos Abatement

1.3 SCOPE OF WORK

- A. This section covers the furnishing of all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements, and waste transport and disposal necessary to perform the work required for LP and LCP removal in accordance with these specifications, drawings and notations, United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), National Institute of Safety and Health (NIOSH), State of California regulations, South Coast Air Quality Management District, and City of Los Angeles Fire Department and all other Applicable Code Requirements.
- B. The work specified herein is the removal, clean-up and disposal of LP and LCP/components by competent persons trained, knowledgeable, and qualified in the techniques of removal, handling, and disposal of lead-containing and lead-contaminated materials, and the subsequent cleaning of contaminated areas; who comply with all Applicable Code Requirements; and who are capable and willing to perform the work according to the Contract Documents.
- C. Furnish on-site supervisory personnel currently certified by the California Department of Public Health (CDPH) as a Project Monitor or Supervisor. Furnish on-site supervisory personnel during all phases of lead- removal related work from on-site mobilization, work area preparation, removal, clean up, to teardown and demobilization.
- D. The work shall also include providing all necessary means of accessing work areas including, removal and reinstallation of doors; temporary ramps, platforms and stairways.

1.4 DISPOSAL REQUIREMENTS

- A. Segregate waste generated during the removal work, lead-paint demolition and construction activities and perform waste characterization sampling and analysis for the following waste streams:
 - 1. Architectural Components/Intact LP and LCP
 - 2. Architectural Components/Intact LP and LCP on Doors/Frames/Trim
 - 3. Plaster, Concrete Walls/Ceilings
 - 4. Sheetrock/Wood Walls/Ceilings
 - 5. Disposables Such As, Rags, Towels, String Mops
 - 6. Wastewater
 - 7. Disposable Suits and Filter Cartridges
 - 8. Polyethylene Sheeting
 - 9. Paint Chips/Sludge
 - 10. Chemical/Caustic Paint Strippers
 - 11. Lead Paint Demolition and Construction Debris
- B. Waste Stream Disposal Requirements:
 - 1. Applicable Abbreviations:
 - a. Total Threshold Limit Concentration (TTLc)
 - b. Soluble Threshold Limit Concentration (STLc)
 - c. Toxicity Leachate Characteristic Procedure (TCLP)
 - d. Milligrams Per Kilograms (mg/kg) = (ppm)
 - e. Parts Per Million (ppm)
 - f. Milligrams Per Liter (mg/l)
 - g. Greater Than or Equal To ($\geq$)
 - h. Less Than ($<$)

2. Sampling, Analysis and Disposal Requirements:
 - a. TTLC 0 - 50 mg/kg Class III Landfill (Architectural Debris)
 - b. TTLC ≥ 50 mg/kg
 < 350 mg/kg
 STLC < 5.0 mg/l Class III Landfill (Architectural Debris)
 - c. TTLC ≥ 50 mg/kg
 < 350 mg/l
 STLC ≥ 5.0 mg/l
 TCLP < 5.0 mg/l Class I Landfill (California Hazardous Waste)
 - d. TTLC ≥ 50 mg/kg
 > 350 mg/kg - $< 1,000$ mg/kg
 STLC < 5.0 mg/l Class I Landfill (California Non-Hazardous Waste/Special)
 - e. TTLC ≥ 50 mg/kg
 > 350 mg/l - $< 1,000$ mg/kg
 STLC ≥ 5.0 mg/l
 TCLP ≥ 5.0 mg/l Class I Landfill Federal (RCRA) Hazardous Waste
 - f. TTLC $\geq 1,000$ mg/kg
 TCLP < 5.0 mg/l Class I Landfill (California Hazardous Waste)
 - g. TTLC $\geq 1,000$ mg/kg
 TCLP ≥ 5.0 mg/l Class I Landfill Federal (RCRA) Hazardous Waste

C. Dispose of all lead waste at one of the following approved facilities:

1. Chemical Waste Management (CWM) – Kettleman Hills
 35251 Old Skyline Road
 Kettleman, CA 93239
 (559) 386-9711
2. Azusa Land Reclamation Co.
 1201 West Gladstone Street
 Azusa, CA 91702
 (626) 334-0719

D. Dispose of chemical and caustic LP remover/stripper and materials contaminated with remover/stripper by incineration. Presently, the only approved facilities are:

1. Clean Harbors (Los Angeles), Inc.
 5756 Alba Street
 Los Angeles, CA 90058
 (213) 585-5063
2. PSC Environmental
 425 Isis Avenue
 Inglewood, CA 90301
 (323) 776-6233

E. Other facilities may be used only if prior written approval is obtained from the University's Representative.

- F. Document actual disposal of the waste at the designated landfill by completing Waste Manifest (s), and Waste Certification Form (s), and waste profiles, and by ensuring their proper completion by the University's Representative, waste transporter, and waste disposal site operator.
1. Within 24 hours of the time waste materials have been removed from the site, deliver all landfill receipts, trip tickets, manifests or other documentation of disposal to:

Environment, Health & Safety
501 Westwood Plaza, 4th Floor
Box 951605,
University of California
Los Angeles, California 90095-1605
Attn: Mr. Dave Ott
 2. Utilize manifest (s) and waste profile (s) to accompany each load of waste that leaves the site. Include the name and address of the Generator (University), Contractor, pick-up site, disposal site, quantity of lead waste disposed and the type of container utilized. Obtain signatures of the Generator's Representative, Transporter and the Disposal Site Operator as the responsibility of the material changes hands.
 3. Secondary Transporters are not allowed unless approved in writing by the University's Representative.
- G. Dispose of architectural components/Intact LP and LCP (e.g., Doors/Frames/Trim, Plaster Walls/Ceilings, Concrete/Brick Walls, Sheetrock/Wood Walls/Ceilings) in an enclosed polyethylene-lined cargo area of a truck, bin or dumpster.
- H. Dispose of disposables (suits, rags, towels, string mops, respirator filter cartridges), polyethylene sheeting, paint chips, chemical/caustic paint strippers, and wastewater in lockable "ring" top 55-gallon steel drums. Store temporarily on site, and transport from the site in an enclosed polyethylene-lined cargo area of a truck, bin or dumpster.
- I. If waste is determined to be a hazardous lead waste based on waste characterization sampling and analysis, transport to the landfill on a hazardous waste manifest. Label the truck (s), bin (s) or dumpster (s), and drums with the following:
1. United States Department of Transportation (USDOT) Class "9" waste classification placards and the following description:

RQ Hazardous Waste Solid, (Lead) (NAERG #171)
 2. Warning Labels:

CAUTION HAZARDOUS WASTE
 3. Generator Name and Address and Disposal Identification Number
 4. Description of the Type of Lead-Containing Material
 5. Date That the Drum Was Filled With Waste
 6. Emergency Phone Numbers
- J. Based upon waste characterization sampling and analysis, dispose of all non-hazardous lead waste at a Class II or Class III landfill.

- K. Prepare all waste transportation containers as follows:
1. Following removal, immediately load all lead waste into an enclosed cargo area of a truck, bin or dumpster for transport to the landfill.
 2. Immediately clean up any visible chips or debris observed on waste containers, carts, or surfaces outside the work area resulting from waste transport and loading activities using HEPA vacuums and/or wet methods as appropriate.
 3. Provide an enclosed cargo area of a truck, bin or dumpster that is free of debris, and line with a minimum of one (1) layer of 6-mil fire-resistant polyethylene sheeting to prevent contamination from leaking containers.
 4. Provide an enclosed cargo area of a truck, bin or dumpster with doors or tops that can be closed and locked to prevent vandalism or other disturbance of the lead waste and wind dispersion of lead dust. Secure and lock the door or top all times with the exception of loading and unloading of lead waste.
 5. Do not place loose, unbagged paint chips, or disposable waste materials in the enclosed cargo area of a truck, bin or dumpster.
 6. Place drums and components on level surfaces in the cargo area and pack together to prevent shifting or tipping.
 7. When parked at the project site, label the outside of the disposal truck, bin or dumpster with the following description:

CAUTION HAZARDOUS WASTE
CONTAINS LEAD

1.5 APPLICABLE STANDARDS AND GUIDELINES

- A. All work conducted in conjunction with lead-related activities shall comply with all Applicable Code Requirements, including those listed below. The publications listed below are incorporated into this specification and shall be considered as if printed herein.
1. Code of Federal Regulations (CFR):
 - a. 29 CFR §1926.050 Stairways and Ladders
 - b. 29 CFR §1910.134 Respiratory Protection
 - c. 29 CFR §1910.145 Specifications for Accident Prevention Signs and Tags
 - d. 29 CFR §1926.62 Lead In Construction
 - e. 29 CFR §1926.59 Hazard Communication – Construction
 - f. 29 CFR §1200 Hazard Communication – General Industry
 - g. 29 CFR §1926.450-454 Scaffolds and Training
 - h. 49 CFR §172 US Department of Transportation (USDOT)
 2. California Code of Regulations (CCR):
 - a. 8 CCR §1532.1 Lead in Construction
 - b. 8 CCR § 5144 Respiratory Protective Equipment
 - c. Title 17 Division 1, Chapter 8 California Department of Health (CDPH) Accreditation, Certification and Work Practices in Lead-Related Construction
 - d. Title 22 Hazardous Waste Handling

- e. 8 CCR § 5194 Hazard Communication
- f. 8 CCR § 3203 Injury and Illness Prevention Program
- 3. United States Department of Housing and Urban Development (HUD):
 - a. Lead Based Paint Guidelines for the Evaluation and Control of Lead Paint in Housing (a.k.a., HUD Guidelines), 1997 Edition
- 4. American National Standards Institute (ANSI) Publications:
 - a. ANSI Z9.2 - 79: Fundamentals Governing the Design and Operation of Local Exhaust Systems
 - b. ANSI Z88.2 - 80: Practices of Respiratory Protection
- 5. Cal. Lab. Code Sections 6501.5, 6501.8, and 6503.5.
- 6. American Society for Testing and Material (ASTM) Publication:
 - a. D2986-95a Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Dioctyl Phthalate) Smoke Test
- 7. Underwriters Laboratories, Inc. (UL) Publication:
 - a. High Efficiency Particulate Air (HEPA) Air Filtration Units

1.6 SUBMITTALS AND NOTIFICATIONS

- A. Related Specifications Sections
 - 1. SECTION 01340 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
 - 2. SECTION 01630 PRODUCT OPTIONS AND SUBSTITUTIONS
- B. Furnish the following to the University's Representative at least 14 days prior to mobilization:
 - 1. A marked-up, site-specific set of floor plans showing locations and lay-out of work area enclosures, decontamination units, air filtration devices, temporary fire protection, waste containers, utility (e.g., water, electrical sources), staging areas, and emergency exiting from the building.
 - 2. Prior to job start, notify all appropriate agencies of the planned removal activities, including:
 - a. California Department of Public Health (CDPH) Five working Days Prior to the Start of Work (CDPH Form 8551)
 - b. California Division of Occupational Safety and Health (DOSH)
 - c. Copies of supervisor/worker training and certification. Include a copy of the current initial or refresher training certificate as issued by a DHS accredited training provider. Attach a copy of DHS issued supervisor/worker certificate for lead-related work.
 - 3. A certificate signed by a licensed physician certifying that each project supervisor/worker is physically able to wear the required respiratory protection and has been examined in accordance with the medical monitoring requirements of 29 CFR §1926.62, and 8 CCR §1532.1 within the previous year.
 - 4. Documentation of medical surveillance required in 8 CCR §1532.1, (j). Conduct blood lead and ZPP monitoring of supervisors/workers prior to the start of work and submit results.
 - 5. Copies of the Contractor's Emergency Preparedness Plan to include the following:
 - a. Project site layout, location of emergency exits, fire protection equipment (e.g., hydrants, standpipes, and sprinkler shut offs, etc.).

- b. Considerations of fire, explosion, electrical hazards, slips, trips and falls, confined spaces, and heat-related injury.
 - c. Project specific periodic training of employees in evacuation procedures in the event of work place emergencies.
 - d. Description of evacuation procedures in the event of work place emergencies.
 - e. Locations and telephone numbers of all emergency response personnel.
6. Current qualitative or quantitative respirator fit testing and training records for all project supervisors/workers which meet the requirements of 29 CFR §1910.134, 29 CFR §1926.62, 8 CCR §5144, and 8 CCR §1532.1.
7. The names, addresses, telephone numbers, and certification/registration numbers of the transporters and disposal site(s) to be utilized for disposing of hazardous and non-hazardous lead waste materials.
8. Description of waste characterization testing and analysis to include sample collection methods, analytical protocols, and name, qualifications/licenses/registrations of analytical laboratory.
9. Written notification to the rental agency regarding intended use of the rental equipment, and a copy of same submitted to the University's Representative when rental equipment is to be used in removal areas.
10. Furnish written description of methods, materials and equipment to be used to remove LP from the exterior, and prepare exterior surfaces for repaint as specified herein. Provide "Mock Up" of two sections for University's Representative's approval. If required by University's Representative, make any changes or adjustments to "Mock Up".
11. Furnish written LP and LCP demolition and LP and LCP construction activities workplan identifying the following:
 - a. A description of each initial Exposure Assessment (EA) to be performed for each type of LP and LCP demolition and construction activity "trigger" task that the Contractor expects to perform.
 - b. A description of demolition and construction activity "trigger" tasks, based on the results of the EAs.
 - c. The type of dust control measures to be used.
 - d. The type of demarcation that shall be used around the lead work control areas.
 - e. The type of personal protective equipment, respiratory protection, housekeeping, decontamination, and engineering controls to be used during the initial EAs and subsequent demolition and construction activity "trigger" tasks, based on the results of the EAs.
 - f. Emergency plan and route of egress from the site.
 - g. A list of prohibited lead-related activities at the site.
 - h. The name and qualifications of the third-party consultant that the Contractor shall be utilizing during the project.
 - i. Identify the independent testing laboratory (name, address, and telephone number) selected to perform analysis of personal air samples. Furnish documentation that the laboratory selected to perform the analyses is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory is certified by the CDPH, and is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT), including accreditation for heavy metal analysis. List experience relevant to the analysis of lead in air and include a Quality Assurance and Quality Control Program (QA/QC). Currently, the American Association for Laboratory Accreditation (AALA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors.

- j. Following completion of EAs, prepare and submit to the University's Representative a written Negative Exposure Assessment (NEA) or EA, based on the results of the initial EAs that includes at least the information specified in 8 CCR 1532.1§(d)(5)(A) and:
 - (1) The date of determination, location within the worksite, and the name and social security number of each employee monitored.
 - (2) All personal air sampling performed by the contractor during the EAs. Furnish personal air sampling results based on an 8-hour TWA.
 - (3) A description of the Trigger Tasks utilized during the EAs.
 - (4) Proposed changes in work procedures, if any, from those that were proposed in the original work plan."
- C. Submit to the University's Representative on a daily basis or whenever requested during the progression of the work, the items listed below. Maintain a copy of the items listed below on the project site at all times:
 - 1. Copies of Contractor's respiratory protection program and injury and illness protection program.
 - 2. Manufacturer's product data and Material Safety Data Sheets (MSDS) for all materials to be used as part of removal activities.
 - 3. SCAQMD permits for all HEPA vacuums and negative air filter units to be used on the project site.
 - 4. Supervisor's daily reports detailing removal activities, worker and visitor access problems and corrective actions taken or proposed, injury reports, equipment breakdown, etc.
 - 5. Logs documenting filter changes on HEPA vacuums, negative air filter units, and shower filters.
 - 6. An updated spreadsheet in Microsoft Excel (hard and electronic copies) showing the names, social security numbers, training expiration dates, medical monitoring expiration dates, and fit test expiration dates for all employees assigned to the project.
 - 7. Copies of all transport manifests with actual weight recorded in pounds or weighmasters certificates for all hazardous and non-hazardous waste materials removed from the work area during the removal process.
 - 8. All personnel air sampling results in accordance with 29 CFR §1926.62 and 8 CCR §1532.1. Post within 24 hours after the collection of the samples.
- D. Product Options and Substitutions:
 - 1. Refer to Section 01630, PRODUCT OPTIONS AND SUBSTITUTIONS.
- E. Submit the following bound close-out documents to the University's Representative within 30 days following completion of the project:
 - 1. Two Copies of Project Log Book as described in 1.06.B and C (cumulative).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Store all materials at the project site or inside the work area that are subject to damage off the ground away from wet or damp surfaces, and under protective cover to prevent damage or contamination.
- B. Do not use and remove all previously used, damaged and/or deteriorating materials from the premises.

- C. Deliver materials in the original packages, containers, or bundles bearing the name of the manufacturer and brand name.
- D. Utilize UL rated, flame-retardant, polyethylene sheeting (opaque in color), or spray-plastics, of 6-mil thickness or greater, in sizes to minimize the frequency of joints.
- E. Utilize duct tape capable of sealing joints or adjacent sheets of plastic, facilitating attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials, and adhering under both dry and wet conditions, including during the use of amended water.
- F. Utilize methylene chloride free spray adhesive capable of providing additional sealing of joints, attachment of plastic sheeting to unfinished surfaces, and adhering under dry and wet conditions, including during the use of amended water. Do not use spray adhesive on vinyl or fabric surfaces to remain, or on masonry.
- G. Utilize minimum ½" in thickness, "C" grade, and certified as fire retardant plywood material for the construction of barriers, tunnels, and floor protection.
- H. Utilize airtight and watertight metal drums with locking ring tops to receive and retain any lead-containing or contaminated materials for storage until disposal at a disposal site. Label the containers as specified herein.
- I. Utilize warning signs in accordance with OSHA standard 29 CFR §1926.62, 8 CCR §1532.1, and Title 22.
- J. Provide any other signs, labels, warning, and posted instructions that are necessary to protect, inform, and warn people of the hazard from lead exposure, including signs required under California Health and Safety Code Section 25916 (Prop 65).
- K. Utilize non-flammable encapsulating agents and primers that shall adhere to the substrate from where LP and LCP/components are to be removed, and do not affect replacement materials ability to bond to the substrate, nor reduce the UL rating of the replacement material.
- L. Utilize methylene chloride - free and non-carcinogenic chemical solvents and paint strippers.
- M. Utilize surfactant (wetting agent) mixture of 50/50 polyoxyethylene ether and polyoxyethylene ester, or equivalent, mixed with water in accordance with manufacturer's printed instructions.
- N. Utilize cleaning solutions capable of remove lead dust and residues. Manufacturer: Fiberlock Technologies, Inc., Product – Fiberlock Lead Prep II®; or equal.

2.2 EQUIPMENT

- A. Provide scaffolds and ladders of sufficient dimension and quantity so that all work surfaces can be easily and safely reached by workers and inspectors. Seal scaffold joints and ends with tape to prevent incursion of lead paint chips/lead-laden dust. Comply with 29 CFR §1926.050, and 8 CCR §1529 and 1646 requirements when using ladders and scaffolding and incorporate guardrails, midrails, toerails, and wheel locks as required.

- B. Provide a sufficient quantity of negative pressure air filtration units equipped with HEPA filtration and operated in accordance with ANSI Z9.2-79 (local exhaust ventilation requirements) and EPA guidance document EPA 560/5-83-002 Guidance for Controlling Friable Asbestos-Containing Materials in Buildings. Calculate total air flow requirement as follows:

$$\text{Total ft}^3/\text{min} = \frac{\text{Vol. of work area (in ft}^3\text{)}}{15 \text{ minutes}}$$

1. To calculate the number of units needed for the r:

$$\text{Number of units needed} = \frac{[\text{total ft}^3/\text{minutes}]}{[\text{capacity of unit in ft}^3/\text{minute}]}$$

- C. Provide a single switch or set of switches for the emergency shutdown of all negative pressure equipment by fire department personnel. Locate the switches in a non-contaminated area near the clean exit of the decontamination unit. Identify using a sign with minimum 3" X 1/2" lettering on a contrasting background that read as follows: "NEGATIVE AIR MASTER SHUT OFF."
- D. Furnish all tools (e.g., scrapers, wire cutters, nylon brushes, utility knives, saws, rubber or plastic dust pans, squeegees, or shovels, etc.), reinforced rubber water hoses, and filter replacements for vacuums, and filtration units as necessary.
- E. Furnish a calibrated incline or digital manometer to measure differential pressure between the inside and outside work areas. Record measurements a minimum of three times per work shift (beginning, middle and end) to ensure that a negative pressure of 0.02 inches of water is maintained.
- F. Furnish airless spray equipment with pumps capable of furnishing 500 pounds per square inch (psi) at the nozzle, and a flow rate of two gallons per minute (gpm) for spraying amended water and encapsulant.
- G. Furnish a sufficient supply of disposable string mops, plastic buckets with wringers, rags, scrub pads, HEPA vacuums with wand brush attachments, and sponges etc. for work area decontamination.
- H. Furnish a sufficient supply of respirator cartridges capable of filtering both lead particulates, and other fumes.
- I. Provide the necessary water filtration units, including filters to filter wastewater through a 0.5 micron final filter.
- J. Utilize mechanical tools and abrasive blast removal equipment equipped with local HEPA-filtered cleaning and dust collection systems.

2.3 RESPIRATORY PROTECTION REQUIREMENTS

- A. Furnish all workers, foremen, superintendents, authorized visitors, and inspectors entering regulated work areas with personally issued respiratory equipment approved by NIOSH. Supply respirator filters and replacements as necessary.

- B. Determine the effectiveness of respiratory protection by evaluating job specific air monitoring data. Utilize appropriate respiratory protection based on air monitoring data to protect airborne exposures to workers, foremen, superintendents, authorized visitors, and inspectors.
- C. At a minimum, utilize half-face piece, negative pressure air purifying respirators (APRs) equipped with HEPA cartridges during work area preparation, pre- removal decontamination, post removal clean up, and tear down.
- D. Until negative exposure assessment (NEA) is performed, assume airborne concentrations for manual demolition of 50 to 500 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). At a minimum, utilize full-face piece (eye protection), negative pressure APRs equipped with HEPA cartridges.
- E. For other lead-related tasks (e.g., torching, welding, use of mechanical means to remove LP and LCP/components, etc.), until NEA is performed, assume airborne concentrations as outlined in 8 CCR §1532.1(d), and provide respiratory protection as specified in (f).

2.4 PERSONAL PROTECTIVE EQUIPMENT

- A. Supply all workers, foremen, superintendents, authorized visitors, and inspectors entering regulated work areas with disposable protective clothing consisting of full body coveralls, with head and foot coverings. Coveralls should be of adequate size and quality to accommodate movement without tearing and to prevent body contamination.
- B. Furnish eye protection (contact lenses shall not be worn and spectacle kits which fit each personal respirator shall be issued), gloves, rubber boots, safety shoes and hard hats as required by job conditions and safety regulations. Rubber boots, safety shoes, and hard hats shall be approved in accordance with ANSI Z89.1 1969 and ANSI Z41.1 1967.
- C. Furnish chemical resistant gloves, face shields, and other protective clothing when utilizing paint strippers, in accordance with manufacturer's instructions.
- D. Provide eyewash station when utilizing paint strippers.
- E. Provide training and fall arrest equipment in accordance with 29 CFR §1926.450-454.
- F. Leave reusable footwear, hard-hats, and eye protection devices in the contaminated equipment room until the end of the lead-related work or place into polyethylene bags, seal, and store in a locked area or storage bin.
- G. Discard and dispose of all disposable protective clothing as lead waste every time the wearer exits from the work space to the outside through the decontamination facilities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review the Contract Documents and perform a pre-construction site investigation to satisfy oneself of the existing conditions affecting the work including:
 - 1. All Applicable Code Requirements.
 - 2. Pre-existing damage and areas of repair that shall not be the responsibility of the Contractor upon completion of removal.

3. The exact quantity of LP and LCP/components and materials to be removed during the course of work. All errors made in estimating, including costs and difficulties, are the sole responsibility of the Contractor, and shall not result in additional expense to the University.
4. The physical considerations and conditions of both the material and structure. These considerations include any obstacles or obstruction encountered in accessing or removing the material.
5. The amount and type of equipment needed to complete the job safely.
6. The availability of utilities.
7. The handling, storage, transportation, and disposal of the material.

3.2 FIRE PROTECTION

- A. Remove and properly dispose of all combustible rubbish and debris, including properly containerized LP and LCP/components and lead-laden dust at the end of each working day.
- B. Utilize fire watch standing by with a 2A/60BC extinguisher during any work requiring open flame.
- C. Meet any and all recommendations for job site safety as may be required by the University's Representative.
- D. Maintain adequate fire extinguishers (Class ABC) ready for immediate use, distributed throughout the work area under removal and in and about flammable temporary structures for the duration of the project. Provide a minimum of four (4) such approved fire extinguishers inside each work area, and others added at the rate of one (1) for every additional 1,000 square feet of work (or at a rate determined by Fire Safety Representative), in the work area, decontamination chamber, and adjacent to the work site.
 1. Exception: Where the total removal containment area is less than 1,000 square feet, provide two (2) (Class ABC) extinguishers.
 2. Clearly demarcate all extinguishers locations with red tape.
 3. Ensure that on site personnel are aware of the location and proper use of all extinguishers and other fire/life safety equipment.
- E. Maintain a fire watch for a minimum of thirty (30) minutes after the cessation of work.
 1. Maintain in place, active and unobstructed all existing exterior fire hydrants and standpipes. Obtain approval from University's Representative for any alteration to this equipment.
- F. Maintain fire/life safety information in the project log.
 1. Prepare a statement at the conclusion of each workday, signed by Contractor, confirming that a survey of the work site has been made and that any unsafe fire/life safety conditions have been rectified.
- G. Maintain a minimum of two (2) clearly marked emergency exits from each floor during the removal. Exits from a containment area may be covered with plastic upon University's Representative's approval. Outline the covered exit with red duct type tape or fluorescent color spray paint, and provide a cutting device, also surrounded by red tape or paint, immediately adjacent to the exit.
- H. Obtain approval of University's Representative prior to temporarily or permanently modifying fire rated partitions, doors, and other fire cutoffs.

- I. Provide the following in containment areas greater than 1,000 square feet:
 - 1. Five (5) extra large "tyvek" type protective coveralls with head and foot coverings, at the entrance to the work area, in a clean, labeled container, for the exclusive use of emergency personnel.

3.3 WORK AREA ACCESS

- A. Restrict access to each work area to authorized, trained, and protected personnel. These may include the Contractor's employees, employees of Subcontractor's, the University's Representative, State and local inspectors, and any other designated individuals.
- B. Report entry into the work area by unauthorized individuals immediately to the University's Representative.
- C. Maintain a log book in a centralized location on the job site. Anyone who enters a regulated work area must record his or her name, social security number, and affiliation.
- D. Access each work area through a single worker decontamination system per work area. Construct decontamination units located outside of the building that shall remain longer than one eight-hour shift of rigid materials (e.g., wood or metal studs and plywood sheathing). Provide locks to prevent unauthorized access.
- E. Block or lock all other means of access (doors, windows, hallways, non-designated elevators, non-designated fire exits, etc.) to prevent entry to or exit from the work area. Maintain access through the waste load-out (during the removal of lead waste from the work area), and emergency exits in case of fire or accident.
- F. Provide all necessary means of accessing work areas including, removal and reinstallation of doors, temporary ramps, platforms and stairways.
- G. Provide project site security in order to protect the site preparation and equipment.
- H. Work Hours:
 - 1. Unless otherwise approved in advance by the University's Representative, complete the work of this project as indicated in Section 01014, Contractor's Use of the Project Site.

3.4 DECONTAMINATION ENCLOSURE SYSTEMS

- A. Provide a three-stage decontamination unit attached to each work area. Each decontamination unit shall be constructed of rigid framing materials covered with 2 layers of opaque polyethylene sheeting. Construct three-stage decontamination units as follows:
 - 1. A clean room separated from the shower room by a weighted curtained doorway; 2) A shower room separated from the equipment room by a weighted curtained doorway; 3) An equipment/dirty room separated from the work area by a weighted curtained doorway or airlock. Provide a waste container for discarded coveralls, towels, and spent respirator cartridges in the equipment room.
 - 2. Provide a staging area around the decontamination facility of sufficient size for workers to change in and out of street clothes and protective clothing, as well as for lockers (for the storage of street clothes and worker/visitor possessions)

- uncontaminated disposable protective clothing, towels, respirators, and equipment. Provide opaque polyethylene sheeting or other suitable material to provide privacy.
3. Provide clean shower facilities (portable metal showers or equal) with hot and cold water adjustable in the shower, and so arranged as to provide complete showering of workers and visitors as they exit from the contaminated area. Furnish an adequate supply of soap, shampoo, and towels in the shower at all times. Make provisions to prevent contaminated water run-off from the shower room (e.g., a tub).
 4. Provide one shower per 10 full-shift removal workers or Subcontractor personnel calculated on the basis of the largest shift.
 5. Filter all water utilized during this project and contaminated by lead. Utilize a filtering system containing a series of several filters (0.5 – 1.0 micron capability) with progressively smaller pore sizes to avoid rapid clogging of the filtration system by large particles. Collect filtered wastewater in a leakproof container (s), prepare waste profile, and dispose accordingly. Dispose of used filters as lead waste. If acceptable to local regulatory discretion, discharge wastewater to a sanitary sewer. Provide any necessary discharge permits and sampling/analysis of wastewater prior to discharge.
- B. Provide a two-stage waste decontamination unit attached to each work area. Each decontamination unit shall be constructed of rigid framing materials covered with 2 layers of opaque polyethylene sheeting. Construct two-stage decontamination units as follows:
1. A clean room separated from the wash room by a weighted curtained doorway; and a shower room separated from work area by a weighted curtained doorway or airlock.
 2. Equip the wash room with the facilities (e.g., water hose or airless sprayer) to wash and wipe the outside of waste containers and components prior to removing them from the work area for transportation to the landfill. Make provisions to prevent any contaminated water run-off from the wash room by providing a child's swimming pool or equivalent water collection device.

3.5 WORK PLACE ENTRY AND EXIT PROCEDURES

- A. Post the following information in the staging area outside the decontamination facility:
1. Telephone/cellular phone numbers/pager numbers for local hospital, location of hospital and/or emergency personnel, local fire department, Contractor's Representatives, and University's Representative.
 2. Copies of notifications to regulatory agencies as required herein.
 3. Copies of Contractor's respiratory protection program and injury and illness protection program.
 4. Copies of the Contractor's emergency procedures as specified herein.
 5. Employee daily sign-in/out log.
 6. Employee/visitor work area entry/exit log.
 7. Cal/OSHA required postings.
 8. Logs documenting filter changes on HEPA vacuums, negative air filter units, and shower filters.
 9. SCAQMD HEPA vacuum and air filtration unit permits.
 10. All personnel air sampling results in accordance with 29 CFR §1926.62 and 8 CCR §1532.1.
- B. Personnel Entry and Exit
1. Furnish all personnel and authorized visitors throughout the removal process with the specified protective clothing and gear. Ensure that all personnel entering and leaving the work area abide by the following procedures:
 - a. Enter the removal work area through the worker decontamination facility.
 - b. Ensure that all personnel, before entering the work area, have read and are familiar with all posted regulations, personal protection requirements

- (including work place entry and exit procedures), and emergency procedures. Furnish a sign off sheet to acknowledge that these have been reviewed and understood by all personnel prior to entry.
- c. Remove all street clothes and appropriately don personal protective equipment and respiratory protection.
 - d. Wearing designated personal protective equipment, workers and visitors proceed to the work area.
 - e. No smoking, eating, drinking, chewing of gum or tobacco, application of cosmetics, or wearing of jewelry while inside the work area.
 - f. Removal of gross contamination from the outside of respirators and protective clothing prior to leaving the work area by brushing and/or HEPA-vacuuming procedures. Provide a walk-off pan (e.g., small children swimming pool filled with water) for workers/visitors to clean off foot coverings prior to leaving the work area and entering the dirty room.
 - g. Proceed to the dirty room of the decontamination enclosure and remove protective coveralls. Continue to wear respirators until in the shower.
 - h. Store reusable, contaminated foot wear and other contaminated equipment in sealed containers in a designated "contaminated" area when not in use in the work area.
 - i. Shower using soap and shampoo to remove lead contamination. Rinse respirator face pieces and parts that are waterproof upon entering the shower. Wet wipe non-waterproof items such as respirator motors or filters. After showering/washing and drying off, proceed to the clean room and don clean disposable clothing for re-entry into the work area or street clothes.
- C. Waste Load-Out Procedures
- 1. Ensure that all waste leaving the work area is done in accordance with the following procedures:
 - a. Transport containerized (drums) of lead contaminated waste and architectural components/Intact LP and LCP/components coated with LP out of the work area through the waste decontamination facility, or into an enclosed polyethylene-lined cargo area of a truck, bin or dumpster directly attached to the work area.
 - b. Utilize two teams of workers, an "inside" team and an "outside" team for waste load-out procedures.
 - c. The inside team, wearing appropriate protective clothing and respirators:
 - (1) Cleans the outside, including the bottoms, of properly labeled drums and architectural components using water hoses or airless sprayers and wet wiping techniques, and then transport the containers into the waste decontamination facility clean room.
 - d. The outside team, wearing protective clothing and respirators:
 - (1) Removes cleaned drums from the waste decontamination facility clean room.
 - e. Transport the waste to the waste container using drum dollies or other suitable equipment. Transport waste to the waste container along unoccupied routes pre-approved by University's Representative, and as indicated in Contractor's submittals.
 - f. If the drums and architectural components are placed directly into an enclosed polyethylene-lined cargo area of a truck, bin or dumpster directly attached to the work area, clean the outside, including the bottoms, of properly labeled drums and architectural components using water hoses or airless sprayers and wet wiping techniques, prior to placing in waste container.

3.6 EXPOSURE CONTROLS

- A. Provide the following exposure controls for the work areas:
1. The means to provide supply air to and exhaust air from the work area to maintain negative pressure. Operate on a 24-hour basis throughout all lead-related work until final air clearance is achieved.
 2. Maintain a static negative air pressure of 0.02 inches (minimum) water at all times in the work area during removal to ensure that contaminated air in the work area does not migrate to uncontaminated areas.
 3. Provide and initiate operation of HEPA-filtered ventilation units as needed to furnish an air change in the work area a minimum of every 15 minutes. Provide a sufficient number of supply and exhaust units to create a stream of air away from the faces of the workers, and in such a way as to not damage or compromise the integrity of the plastic isolation barriers.
 4. Maintain at all times, at minimum, two HEPA-filtered ventilation units as back-ups in case of failure of any operating units or as means to maintain static negative air pressure.
 5. Provide ventilation units at the opposite end of the decontamination facility in order provide air flow across the work area.
 6. Provide an on-site static pressure strip-recording manometer with an audible alarm or fluid incline manometer for all work areas. Submit tape chart recordings or measurements daily to the University's Representative.
 7. Seal all openings made in the enclosure system made to accommodate ventilation units airtight with tape and/or caulking as needed.
 8. If more than one unit is provided, turn the units on one at a time, checking the integrity of wall barriers for secure attachment and need for additional reinforcement.
 9. On electric power failure, stop all work immediately, do not resume until power is restored and exhaust units are operating again. On extended power failure, (longer than 1 hour), seal the decontamination facilities air tight after the evacuation of personnel from the work area.
 10. Exhaust HEPA filtered ventilation units to the outside of the building no closer than fifty (50) feet to any building HVAC supply vents or other air system intakes, or entrances/exits of occupied areas.

3.7 MAINTENANCE OF WORK PLACE BARRIERS AND WORKER DECONTAMINATION ENCLOSURE SYSTEMS

- A. Inspect all polyethylene barriers inside the work area, in the worker decontamination enclosure system, and at partitions constructed to isolate the work area from occupied areas, before the start of each shift and at least twice daily during the shift. Document inspections and observations in the daily project log.
- B. Repair damage and defects in the enclosure system immediately upon discovery.
- C. Utilized air current (smoke) tubes to test the effectiveness of the work area barriers, the worker and equipment decontamination systems with the negative pressure ventilation units in operation before removal work at least once for each shift, or when requested by the University's Representative. Document results and observations in the project log book.
- D. If visible material is observed outside of the work area or if damage occurs to barriers, immediately stop work, repair barriers, and clean up debris/residue using appropriate HEPA vacuuming and wet wiping procedures.

- E. If air samples collected outside of the work area during removal activities indicate airborne lead concentrations greater than 15 ug/m^3 , and surface wipe sample results greater than or equal to 40 micrograms per square foot ($\geq 40 \text{ ug/ft}^2$) for interior floor surfaces, 250 ug/ft^2 for interior horizontal window surfaces, 400 ug/ft^2 for window troughs, 800 ug/ft^2 for exterior floor surfaces, and 1,000 parts per million (ppm) for soil, or pre-measured background levels (whichever is higher), stop work immediately for inspection and repair of barriers. Cleanup of surfaces outside of the work area, using HEPA vacuums or wet cleaning solution, as necessary.

3.8 INITIAL CLEANING

- A. Pre-clean all movable objects in the work area using HEPA vacuuming or wet-cleaning methods as necessary to remove all visible dust and debris. After cleaning, remove objects from the work area and dispose or store in an uncontaminated location as approved by University's Representative.
- B. Pre-clean all fixed objects (e.g., walls, floors, ducts, suspended ceilings, etc.) in the work area using HEPA vacuuming or wet-cleaning methods as necessary to remove all visible dust and debris.
- C. Dispose of all suspect debris and contaminated filters, mop heads, cloths, wastewater, etc. used to perform pre-cleaning work in sealed, leak-proof containers.

3.9 WORK AREA PREPARATION

- A. General:
 - 1. Warning Signs:
 - a. Post caution signs meeting the specifications of 29 CFR §1926.62, CCR 8 CCR §1532.1, and Title 22, Part 12601 at appropriate approaches to the work area where airborne concentrations of lead may exceed ambient background levels. Post signs a distance sufficiently far enough away from the work area so as to permit an employee or visitor to read the sign and take the necessary protective measures to avoid exposure. Post additional signs following construction of work place enclosure barriers at all entrances and exits to the work area.
 - 2. Electrical Equipment:
 - a. Use methods, as necessary, to protect stationary electrical equipment including panel boards, and transformers, scheduled to remain energized.
 - b. Obtain University's Representative's approval prior to any utility shutdown in accordance with Section 01500 Construction Facilities and Temporary Controls.
 - 3. Temporary electrical service:
 - a. Provide and maintain all necessary temporary ground fault electrical power service, distribution, equipment, connections, etc., as necessary for the Work. Before final acceptance, remove all temporary equipment and connections provided in a manner approved by University's Representative.
 - b. Coordinate with the University's Representative, the shut down, lock out and isolation of electrical systems. Label electrical conduits or cabling running through the work area that shall remain in operation during the removal.
 - c. Make temporary service connections to the existing electrical distribution system at a point which shall be made available by the University's Representative.

- (1) Provide spider boxes or similar devices to provide power from the panelboard to the work area for small tools and lighting. Power for larger equipment and lighting for use inside the work area during removal may be taken directly from panelboards as approved by University's Representative.
 - (2) Do not allow the load connected to any circuit to exceed 25% of the feeder capacity as labeled on the panel board.
 - (3) Do not disturb cables and conductors which may prevent closing of fire-labeled doors.
 - (4) Provide ground fault interrupter outlets in order to allow for temporary electric power hook ups.
 - (5) Furnish an electrician or electrical Subcontractor with a current State of California Contractor's C-10 (Electrical -General) license in order to accomplish required electrical hook ups and equipment installations.
 - (6) Comply with NEMA, MECA and UL standards and CAL/OSHA requirements.
 4. Temporary Lighting:
 - a. Provide "string type" general service incandescent lighting with guarded cages and portable plug in task lighting of sufficient wattage throughout the work area to supply a 20 foot candle minimum light level.
 - b. Temporary lighting may be used in combination with natural lighting to achieve minimum light level.
 5. HVAC Systems:
 - a. Coordinate with the University's Representative, the shut down, lock out and isolation of heating, cooling, and ventilating air systems. Maintain shutdown throughout the removal to prevent contamination and lead dust dispersal to other areas of the structure and outside the building.
 - b. Seal all intake and exhaust vents leading from the work area with two layers of 6-mil polyethylene sheeting and duct tape. Seal seams in HVAC components to remain, that pass through the work area prior to covering with poly sheeting.
- B. Removal of LP and LCP/components utilizing full containment methodologies using mechanical means (e.g., sanding, grinding, scraping, abrasive blasting, etc.):
 1. Architectural components/intact LP and LCP/components;
 2. Spot Removal Locations;
 3. Two feet (2') per side of point of cut on any building components requiring welding, torch cutting or grinding during removal and demolition.
 - a. Decontaminate and remove non-fixed items from the work area and dispose or store in an uncontaminated location as approved by the University's Representative.
 - b. Provide pre-cut plywood manifolds in windows or louvers at point (s) where HEPA exhaust ducts exit the building. Paint the exterior of the plywood beige. Caulk and seal the plywood manifolds airtight.
 - c. Provide critical barriers of, at minimum, two layers of 6-mil polyethylene sheeting individually secured with spray adhesive (except for where masonry surfaces exist), and then taped over all openings leading from the work area including windows, doors, diffusers, etc.
 - d. Prior to the installation of polyethylene critical barriers at openings that lead to the exterior of the building, and that shall not be used as emergency egress, provide minimum ½" thickness plywood material and rigid framing.

- e. Identify and seal with firestop, spray foam, or equal, all floor/ceiling penetrations, including, drains, cracks, expansion joints, cable runs, conduits, pipes runs or ducts.
 - f. Connect worker/waste decontamination facilities and HEPA filtration devices as per Paragraph 3.4 and 3.6 herein.
 - g. Demarcate emergency exits and path of travel to emergency exits with bright colored arrows or spray paint, located approximately 30" above the floor.
 - h. Provide sufficient view ports to allow persons outside the work area to view all parts of the work area.
 - i. Cover floors in the work area with two layers of 6-mil, fire retardant polyethylene sheeting. Secure floor sheeting so as to prevent it from moving during demolition/ removal. This may require additional support/attachments.
 - j. Provide 2 layers of 6-mil poly sheeting over fixed items to remain in the work area to protect from damage during lead demolition/ removal.
 - k. Size plastic to minimize seams. Stagger successive layers of sheeting to reduce the potential for water to penetrate beyond the floor sheeting. Do not locate any seams at wall/floor joints.
 - l. Separate seams by at least a distance of six feet. Overlap all seams by a minimum of 12 inches, and secure by first applying spray adhesive and then firmly securing with tape.
 - m. After installation and operation of critical barriers, decontamination facilities, and HEPA filtration devices, and floor coverings, request, receive, and pass a pre- removal visual inspection arranged by the University's Representative prior to initiation of removal activities. Operate HEPA filtration devices for at minimum two hours prior to requesting a pre- removal visual inspection.
- C. Removal of LP and LCP/components utilizing modified containment methodologies (non-mechanical means (e.g., chemical strippers, hand scraping, hand wet sanding, HEPA shroud mechanical hand tools, etc.) from the following:
- 1. Architectural components/intact LP and LCP/components;
 - 2. Spot Removal Locations;
 - 3. Two feet (2') per side of point of cut on any building components requiring welding, torch cutting or grinding during removal and demolition.
 - a. Decontaminate and remove non-fixed items from the work area and dispose or store in an uncontaminated location as approved by the University's Representative.
 - b. Provide critical barriers of, at minimum, two layers of 6-mil polyethylene sheeting individually secured with spray adhesive (except for where masonry surfaces exist), and then taped over all openings leading from the work area including windows, doors, diffusers, etc.
 - c. Identify and seal with firestop, spray foam, or equal, all floor/ceiling penetrations, including, drains, cracks, expansion joints, cable runs, conduits, pipes runs or ducts.
 - d. Provide worker decontamination/wash station.
 - e. Cover floors in the work area with one layer of 6-mil, fire retardant polyethylene sheeting. Secure floor sheeting so as to prevent it from moving during demolition/ removal. This may require additional support/attachments.
 - f. Size plastic to minimize seams. Stagger successive layers of sheeting to reduce the potential for water to penetrate beyond the floor sheeting. Do not locate any seams at wall/floor joints.

- g. Separate seams by at least a distance of six feet. Overlap all seams by a minimum of 12 inches, and secure by first applying spray adhesive and then firmly securing with tape.
- h. After installation and operation of critical barriers, decontamination facilities, and HEPA filtration devices, and floor coverings, request, receive, and pass a pre- removal visual inspection arranged by the University's Representative prior to initiation of removal activities.

3.10 REMOVAL OF LP AND LCP/COMPONENTS

A. Full-Containments

- 1. Properly prepare work area as described in Paragraph 3.9 herein.
- 2. Wet all LP and LCP/components with an amended water solution. Utilize equipment capable of providing a fine spray mist, in order to reduce airborne particulate concentrations when the material is disturbed. Do not allow excessive water to accumulate in the work area. Keep all removed material wet until it can be containerized for disposal.
- 3. Maintain high humidity in the work area by regular misting until all visible material has been cleaned up.
- 4. Once saturated, remove all LP and LCP/components.
 - a. Architectural components/Intact LP and LCP. Remove in manageable sections using hand-held tools and methods that minimize delamination of paint and generation of paint chips or dust.
 - b. Plaster, Concrete, Brick, Sheetrock, Wood, Ceramic Tile/Glazing. Remove in manageable sections using hand-held tools (e.g., hammers, axes, scrapers, prybars, etc.) and methods that minimize delamination of glazing and generation of dust.
 - c. Defective (e.g., peeling, alligatoring, flaking or otherwise delaminating) LP and LCP/components from building components. Remove using approved hand held scrapers, hand held mechanical tools (e.g., sanders, needle guns, abrasive blasting, etc.) and chemical strippers.
 - d. Intact LP and LCP from building components: Remove using approved hand held scrapers, hand held mechanical tools (e.g., sanders, needle guns, abrasive blasting, etc.) and chemical strippers.
- 5. Promptly drum paint chips and dust generated as a result of demolition activities. Periodically spray the work area to maintain in a wet condition.
- 6. Seal drums when full. Securely seal with locking ring tops.
- 7. Detail clean all surfaces in the work area to remain including utility lines, hangars, conduit, junction boxes, and sprinkler lines.
- 8. Clean up work areas as described in Paragraph 3.12 and 3.13 herein.

B. Modified Containment Methodologies

- 1. Properly prepare work area as described in Paragraph 3.9 herein.
- 2. Wet all LP and LCP/components with an amended water solution. Utilize equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Do not allow excessive water to accumulate in the work area. Keep all removed material wet until it can be containerized for disposal.
- 3. Maintain high humidity in the work area by regular misting until all visible material has been cleaned up.
- 4. Once saturated, remove all LP and LCP/components.

- a. Architectural components/Intact LP and LCP. Remove in manageable sections using hand-held tools and methods that minimize delamination of paint and generation of paint chips or dust.
 - b. Plaster, Concrete, Brick, Sheetrock, Wood. Remove in manageable sections using hand-held tools (e.g., hammers, axes, scrapers, prybars, etc.) and methods that minimize delamination of glazing and generation of dust.
 - c. Defective (e.g., peeling, alligatoring, flaking or otherwise delaminating) LP and LCP from building components. Remove using approved hand held scrapers, hand sanding, hand held mechanical tools (e.g., sanders and needle guns equipped with HEPA shroud dust collection systems) and chemical strippers.
 - d. Intact LP and LCP from building components: Remove using approved hand held scrapers, hand sanding, hand held mechanical tools (e.g., sanders and needle guns equipped with HEPA shroud dust collection systems) and chemical strippers.
5. Promptly drum paint chips and dust generated as a result of demolition activities. Periodically spray the work area to maintain in a wet condition.
 6. Clean up work areas as described in Paragraph 3.12 and 3.13 herein.

3.11 LEAD PAINT DEMOLITION AND CONSTRUCTION ACTIVITIES

- A. Retain a third party lead consulting firm to perform exposure assessments (EA) during representative demolition and construction activity “trigger” tasks as specified in 8 CCR §1532.1.
- B. Prepare and submit proposed EA workplan for each type of demolition and construction activity to be performed, perform initial EAs and submit results of EAs to the University’s Representative prior to performing any lead-related demolition or construction activity.
- C. Provide lead dust control measures, lead waste and debris retention areas, worker protection, and decontamination areas in accordance with this Section, the Contractor’s work plan, and lead EA data.
- D. Pre-Project Initial EA:
 1. Prior to performing any lead-related demolition work, perform initial EAs as described in 8 CCR §1532.1.
 2. During pre-project EA utilize Supervisors/Competent Persons who are certified as Lead-Related Construction Supervisors and Lead-Related Construction Workers in accordance with 17 CCR, Division 1, Chapter 8.
- E. Perform initial EAs in accordance with this Section and the Contractor’s lead-related demolition work plan required by Paragraph 1.6 SUBMITTALS AND NOTIFICATIONS.
- F. Perform initial EAs for a minimum of two(2) full days (two 8-hour shifts) and include all work practices and trigger tasks that the Contractor expects to encounter during lead-related demolition work.
- G. Collect personal air samples as part of the EAs utilizing third party consulting firm.
- H. If the results of the EA indicate that the Action Level (AL) shall not be exceeded during the work, the following lead-related worker protection, engineering controls, training and certification requirements shall be required. Refer to the appropriate sections of 8 CCR §1532.1 for a complete description of requirements.

1. Respirator if requested by employee.
 2. Hand washing facilities.
 3. Housekeeping.
 4. An employee's right to access to records under 29 CFR §1910.1020.
 5. The contents and requirements of 29 CFR §1926.62 and 8 CCR §1532.1.
 6. The specific nature of the operation that could result in exposure to lead.
 7. The purpose, proper selection, fitting, use, and limitations of respirators.
 8. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health affects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant).
 9. Relevant engineering controls and good work practices.
 10. The contents of any compliance plan in effect.
 11. Instructions that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
- I. If the results of the EA indicates that the Action Level (AL) 30 micrograms per cubic meter (30 ug/m³) shall be exceeded but below the Permissible Exposure Limit (PEL) (50 ug/m³) during the work, the following lead-related worker protection, engineering controls, training and certification requirements, in addition to those listed in Paragraph (H) above shall be required. Refer to the appropriate sections of 8 CCR §1532.1 for a detailed description of requirements.
1. Blood Lead Level (BLL) and Zinc Protoporphyrin (ZPP) monitoring.
 2. Protective Clothing.
 3. Medical Exam.
- J. If the results of the EA indicate that the PEL shall be exceeded during the work, the following lead-related worker protection, engineering controls, training and certification requirements, in addition to those listed in Paragraphs (H and I) above shall be required. Refer to the appropriate sections of 8 CCR 1532.1 for a detailed description of requirements.
1. Engineering controls and work practices.
 2. Written Compliance Program.
 3. Mechanical Ventilation.
 4. Administrative Controls.
 5. Respiratory Protection.
 6. Regulated Area.
 7. Decontamination Facilities.
 8. Changing Areas.
 9. CDPH certified supervisors/worker.
 10. Signs.
- K. If the Contractor's means and methods for the EAs change from those presented in the lead-related demolition work plan and during the work, perform another EA to determine lead-related worker protection, engineering controls, training and certification requirements for the lead-related demolition workers.
- 3.12 CLEAN-UP PROCEDURES – GENERAL
- A. Promptly clean up visible accumulations of loose paint chips and lead-laden dust.

- B. Collect lead-containing or contaminated materials utilizing rubber or plastic dust pans, shovels, and squeegees or HEPA vacuums.
- C. Do not use metal shovels or brooms within the work area.
- D. Clean up visible accumulations of lead-containing or contaminated materials from all surfaces in the work area on a daily basis.
- E. Wet wipe all surfaces in the work area using rags, string mops, plastic buckets with wringers, sponges, and lead cleaning solution as needed to remove all visible residue.

3.13 FINAL CLEANING

- A. Remove all containerized waste from the work area and decontamination facilities.
- B. Remove all tools and equipment (except for equipment needed to complete final cleanings and air filtration units, critical barriers, polyethylene sheeting) from the work area and properly decontaminate in the decontamination facility.
- C. Remove layers of plastic sheeting from floors. Maintain in place and operation critical barriers, air filtration devices and decontamination facilities.
- D. Conduct three stage cleaning in the work area. Start from the farthest end of the work area from the decontamination facilities exit and clean toward the decontamination facilities.
 - 1. HEPA vacuum all surfaces in the work area.
 - 2. Wet clean all surfaces in the work area using lead cleaning solution. Utilize the “3 bucket” system (cleaning solution, Empty, and water) when wet cleaning.
 - 3. HEPA vacuum all surfaces in the work area.
- E. Request and pass a pre-clearance (pre-encapsulation) visual inspection arranged by the University’s Representative.
- F. Re-clean work area, at no additional cost, as requested or as necessary to remove all visible paint chips, residue and debris. Repeat cleaning cycles as described above. Request and pass pre-clearance visual inspection (s).
- G. Apply Lock-down encapsulant (primer) to all surfaces in the work area.
- H. The performance of the pre-clearance visual inspection (s) and clearance settled dust wipe sampling shall be arranged by the University’s Representative. Refer to Paragraph 3.14 herein.
- I. After passing pre-clearance inspections and final clearance settled dust wipe sampling, remove all remaining plastic sheeting, critical barriers, air filtration equipment, and breakdown decontamination facilities.
- J. Inspect the work area with University’s Representative, and clean-up any visible debris that may still be present.
- K. Remove all waste, materials, and equipment used to complete the work.
- L. Request and pass a post teardown visual inspection from the University’s Representative.

- M. Repair damages caused during removal activities (e.g., paint peeled by duct tape removal, nail holes, water damage, broken glass, etc.), at no additional cost to the University. Restore the work area and auxiliary areas used to perform the removal work to conditions equal to pre-removal conditions.

3.14 INSPECTION SEQUENCE

- A. After properly preparing the work area, request, receive, and pass a pre-removal visual inspection arranged by the University's Representative prior to initiation of removal activities. Do not commence removal work until after passing the pre-removal visual inspection and the University's Representative has approved of the following:
 - 1. Work area enclosure systems have been constructed and inspected.
 - 2. HEPA air filtration devices are functioning adequately.
 - 3. All pre-removal submissions, notifications, postings and permits have been provided and are satisfactory to University's Representative.
 - 4. All labor, materials and equipment for removal, cleanup and disposal are on hand.
 - 5. All worker training and certification is completed in conjunction with Contractor's daily inspections, the University's Representative shall perform daily inspections, air monitoring, and settled dust wipe sampling. Immediately, without cost to University's Representative, correct deficiencies identified during daily inspections, air monitoring, and wipe sampling and make all necessary modifications to the satisfaction of the University's Representative.
- B. After removal of all LP and LCP/components materials, initiate final cleaning procedures as described in Paragraph 3.13 herein. After completion of final cleaning (s), request, receive, and pass pre-clearance inspection (s), final clearance settled dust wipe sampling and analysis, and post-teardown inspection (s) as described in Paragraph 3.13 and 3.15 herein.

3.15 AIR MONITORING

- A. Furnished Air Monitoring
 - 1. The University shall furnish a trained CDPH lead-related construction monitor (LRCM) to perform inspection, air monitoring, and settled dust wipe sampling services to monitor the Contractor's compliance with the specifications, applicable regulations, University policies, and standard industry work practices.
 - 2. Area air monitoring shall be performed daily by the University or designated representative during preparation, removal, and cleaning. The monitoring shall occur both inside and outside the work area, so as to accurately assess the airborne lead levels.
 - 3. LP and LCP/Components Clearance Criteria:
 - a. Less than (<) 40 ug/ft² for interior floor surfaces
 - b. < 250ug/ft² for interior horizontal surfaces
 - c. < 400 ug/ft² for exterior floor and exterior horizontal surfaces
 - d. < 1,000 ppm for soil
 - 4. At no cost to the University, Contractor shall reclean work areas as described herein, that do not meet the clearance criteria established herein.
 - 5. Contractor shall be responsible for subsequent sampling (labor costs) and analytical costs due to initial clearance failures.
- B. Contractor Provided Air Monitoring

1. During the first full four (4) shifts of removal activities, provide a trained CDPH lead-related project monitor to perform personal sampling services.
 2. Conduct personal air monitoring daily throughout the duration of lead removal activities to determine accurately the airborne concentrations of lead to which workers may be exposed, in accordance with 29 CFR §1926.62 and 8 CCR §1532.1.
 3. Take samples in such frequency and pattern as to represent, with reasonable accuracy the level of exposure to all workers. The recommended percentage of workers is 25%, at a minimum.
 4. Utilize an analytical laboratory to perform sample analysis that is certified by the California Environmental Accreditation Program (CA ELAP), and is a successful participant in the American Industrial Hygiene Association (AIHA) Environmental Laboratory Proficiency Analytical Testing (ELPAT) program.
 5. Post monitoring results and appropriate laboratory analysis work in the staging area, with a copy submitted to University's Representative within twenty-four hours from the time the samples were collected.
- C. Contractor Provided Waste Characterization
1. Conduct representative sampling and analysis of waste streams to determine if waste is hazardous. Conduct Total Threshold Limit Concentration (TTLC), Soluble Threshold Limit Concentration (STLC) and Toxicity Characterization Leaching Procedure (TCLP) as outlined in Contractor's submittal to meet landfill, CCR Title 22 Section 66261.24 requirements, and as specified in Paragraph 1.4 herein.

3.16 STOP WORK ORDER

- A. University's Representative shall have the right to issue a Stop Work Order whenever Contractor's work engineering controls, or air monitoring results are not in accordance with published regulations, contractual restrictions, or the removal specifications. All costs resulting from the Stop Work Order shall be at Contractor's expense. Refer to General Conditions Article 2.3.1.
- B. The Stop Work Order shall first be given verbally to Contractor by the University's Representative, at which point all work shall cease. This shall be immediately followed by a written notification to stop work. If the situation is not corrected to the University's Representative satisfaction within forty-eight (48) hours, Contractor shall be considered to be in breach of the Contract and shall be subject to termination in accordance with General Conditions Article 13.2.

END OF SECTION

SECTION 02082- MISCELLANEOUS HAZARDOUS MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes:

1. The proper set-up, removal, decontamination, incineration, and disposal of the following polychlorinated biphenyls (PCBs) and/or Diethylhexyl Phthalates (DEHPs):
 - a. (10) Light ballasts from 2' x 4', 1' x 4', 1' x 2', and 2' X 2' fluorescent light fixtures:
 - (1) Place ballasts in 55-gallon drum (s), not to exceed approximately 750 pounds for transport from the site.
 - (2) Utilize an approved recycler to transport ballasts (from site if PCBs and/or DEHPs); to clean carcasses and components. Incinerate PCB-containing capacitors, asphalt potting material, and leaking ballasts.
2. The proper set-up, removal, and disposal of the following "Universal Waste":
 - a. (20) Fluorescent Light Tubes:
 - (1) Package Universal Waste in order to prevent damage from the time of removal, during temporary storage on site, and transport to the recycler.
 - (2) Utilize an approved recycling facility to process and dispose of Universal Waste.

- B. Verify actual quantities and sizes by field observation, review of as built and Architectural drawings or other suitable method.

1.2 RELATED WORK

- A. Section 01014: Contractor's Use of the Project Site
- B. Section 01060: Regulatory Requirements
- C. Section 01340: Shop Drawings, Product Data and Samples
- D. Section 01500: Construction Facilities and Temporary Controls
- E. Section 01510: Temporary Utilities
- F. Section 01630: Product Options and Substitutions
- G. Section 02080: Asbestos Abatement
- H. Section 02081: Lead Removal

1.3 SCOPE OF WORK

- A. This section covers providing of all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements, and waste transport and disposal necessary to perform the work required for the removal, recycling, incineration, transport, and disposal of PCBs and/or DEHPs, fluorescent light tubes, hazardous waste, and associated components in accordance with these specifications, and notations, United States Environmental Protection

Agency (EPA), Occupational Safety and Health Administration (OSHA), United States Department of Transportation, (USDOT), National Institute of Safety and Health (NIOSH), State of California regulations, South Coast Air Quality Management District, City of Los Angeles Fire Department and any other Applicable Code Requirements.

- B. The work specified herein is the removal, clean-up, and recycling, disposal, or incineration of PCB and/or DEHP hazardous waste, and universal wastes by competent persons trained, knowledgeable, and qualified in the techniques of removal, handling, and disposal of PCBs and/or DEHPs and universal wastes and associated components, and the subsequent cleaning of contaminated areas; who comply with all Applicable Code Requirements; and who are capable and willing to perform the work according to the Contract Documents.

1.4 DISPOSAL REQUIREMENTS

A. Polychlorinated Biphenyls (PCBs) and Diethylhexyl Phthalates (DEHPs):

1. Dispose of cleaned carcasses and components, and incinerate PCB and/or DEHP waste at an approved facility (s).
2. Determine current waste handling, transportation, and disposal regulations for the work site and for each waste disposal landfill.
3. Document actual incineration, recycling, and disposal of the waste at the designated facility (s) and landfill by completing Waste Manifest (s), Waste Certification Form (s), waste profiles, and by ensuring their proper completion by the University's Representative, waste transporter, and waste disposal site operator.
 - a. Within 24 hours of the time waste materials have been removed from the site, deliver all landfill receipts, trip tickets, manifests or other documentation of disposal to:

Environment, Health & Safety
501 Westwood Plaza, 4th Floor
Box 951605,
University of California
Los Angeles, California 90095-1605
Attn: Mr. Dave Ott
 - b. Utilize manifest (s) to accompany each load of waste that leaves the site. Include the name and address of the Generator (University), Contractor, pick-up site, disposal site, quantity of PCB and/or DEHP waste disposed and the type of container utilized. Obtain signatures of the Generator's Representative, Transporter and the Disposal Site Operator as the responsibility of the material changes hands.
 - c. Secondary Transporters are not allowed unless approved in writing by University's Representative.
4. Furnish a statement certifying recycling/disposal/destruction of the identified PCB waste, including the date(s) of recycling/disposal/destruction, and identifying the disposal/destruction process used.
5. Dispose of PCB or DEHP-containing liquids in USDOT 17E containers.
6. Dispose of ballasts in "UN1A2" or 17C or 17H lockable "ring top" 55-gallon steel drums. Transport on a hazardous waste manifest. Label the containers with the following descriptions:
 - a. United States Department of Transportation (USDOT) Class "9" waste classification placards and the following description:

RQ Polychlorinated Biphenyls Mixture, 9, UN2315, PG III

Or

RQ Diethylhexyl Phthalate Mixture, 9, UN 3082, PG III

b. Warning Labels:

CAUTION HAZARDOUS WASTE
CONTAINS PCBS
POLYCHLORINATED BIPHENYLS
Or
CAUTION HAZARDOUS WASTE
CONTAINS DEHPS
DIETHYLHEXYL PHTHALATES

- c. Generator Name and Address and Disposal Identification Number
- d. Description of the Type of Lead-Containing Material
- e. Date That the Drum Was Filled With Waste
- f. Emergency Phone Numbers

B. Universal Waste:

- 1. Dispose of Universal Wastes at a recycling/treatment facility (s) approved by University's Representative, and authorized by Cal/EPA DTSC or the state in which they are located to receive the waste.
- 2. Determine current waste handling, transportation, and disposal regulations for the work site and for each recycling and disposal facility.
- 3. Document actual recycling/treatment, and disposal of the waste at the designated facility (s) by completing bill(s) of lading.
 - a. Within 24 hours of the time waste materials have been removed from the site, deliver all bill(s) of lading to University or University's Representative.
 - b. Utilize bill(s) of lading to accompany each load of waste that leaves the site. Include the name and address of the Generator (University), Contractor, pick-up site, disposal site, and quantity of universal waste disposed.
- 4. Furnish a statement certifying recycling/disposal/destruction of the identified universal waste, including the date(s) of recycling/disposal/destruction, and identifying the disposal/destruction process used.
- 5. Transport fluorescent light tubes in containers that prevent damage and release. Label the containers with the following:
 - a. Warning Labels:

LAMPS: "UNIVERSAL WASTE - - LAMPS",
or "WASTE LAMP(S)", or "USED LAMP(S)"

THERMOSTATS: "UNIVERSAL WASTE - - MERCURY THERMOSTAT(S)",
or "WASTE MERCURY THERMOSTAT(S)"
or "USED MERCURY THERMOSTAT(S)"

- b. Generator Name and Address
- c. Description of the Type of Universal Waste
- d. Accumulation Start Date of the Universal Waste
- e. Emergency Phone Numbers

1.5 APPLICABLE STANDARDS AND GUIDELINES

- A. All work conducted in conjunction with PCB-related activities shall be in strict accordance with all Applicable code requirements governing miscellaneous hazardous materials work listed below. The publications listed below are incorporated into this specification and shall be considered as if printed herein. In addition to the codes and regulations specified in Section 01060, REGULATORY REQUIREMENTS, Applicable laws and regulations include:

1. Code of Federal Regulations (CFR):
 - a. 29 CFR §1926.050 Stairways and Ladders
 - b. 29 CFR §1910.1000 Air Contaminants
 - c. 40 CFR Part 82 Halon Emission Reduction
 - d. 40 CFR Part 761 Polychlorinated Biphenyls,
Manufacturing,
Processing, Distribution, and Use
Prohibitions
 - e. 29 CFR §1910.134 Respiratory Protection
 - f. 29 CFR §1910.145 Specifications for Accident Prevention
Signs and Tags
 - g. 29 CFR §1926.59 Hazard Communication - Construction
 - h. 29 CFR §1200 Hazard Communication – General
Industry
Scaffolds
 - i. 29 CFR §1926.450-453 Polychlorinated biphenyls (PCBs)
 - j. 40 CFR 761 Manufacturing, Processing,
Distribution in Commerce, and
Use Prohibitions
 - k. 40 CFR 273 Standards for Universal Waste
Management
 - l. 49 CFR §171-185 US Department of Transportation
(USDOT)
2. California Code of Regulations (CCR):
 - a. 8 CCR §5144 Respiratory Protective Equipment
 - b. 8 CCR §5192 Hazardous Waste Operations and
Emergency Response
 - c. 8 CCR §5194 Hazard Communication
 - d. 8 CCR 3203 Injury and Illness Prevention Program
 - e. Title 22 Chapter 42 Requirements for Management of
Fluorescent Light Ballasts Which Contain
Polychlorinated Biphenyls (PCBs)
 - f. Title 22 Chapter 23 §66261.9 Requirements for Universal
Waste
3. American National Standards Institute (ANSI) Publications:
 - a. ANSI Z88.2 - 80: Practices of Respiratory Protection

1.6 SUBMITTALS AND NOTIFICATIONS

- A. Related Specifications Sections
1. SECTION 01340 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

B. Furnish the following to the University's Representative at least 14 days prior to mobilization:

1. Spill Prevention Control and Countermeasure Plan (SPCC).
2. Copies of any required agency notifications.
3. Detailed job-specific plan of the work procedures to be used in the removal of PCB and/or DEHP-containing materials. Include a sketch showing the location, size, and details of PCB control areas. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of PCB and/or DEHP related work, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that PCB and/or DEHP contamination is not spread or carried outside of the control area.
4. Submit a PCB and/or DEHP Disposal Plan that complies with all applicable requirements of federal, state, and local PCB waste regulations and address:
 - a. Identification of PCB or DEHP wastes associated with the work.
 - b. Estimated quantities of wastes to be generated, recycled, incinerated and disposed.
 - c. Names and qualifications of each entity that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a point of contact. Furnish copies of certification/registrations numbers.
5. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous and PCB wastes.
6. Name and qualifications of laboratory to be used to analyze waste characterization samples.
7. Certificate (s) of recycling/destruction/incineration for PCBs and/or DEHPs and universal wastes.
8. Documentation of satisfactory employee, and supervisor training per 29 CFR §1910.120 (HAZWOPER) training. Submit certificates showing the dates of training and training entity.
9. Documentation that employees have been properly trained in the handling, packaging, storing, labeling, and response to releases of universal wastes.
10. Names of each entity that will be transporting, storing, recycling/treating, and disposing of fluorescent light tubes. Include the facility location and a point of contact. Furnish copies of certification/registrations numbers.
11. Detailed job-specific plan of the work procedures to be used in the removal of universal wastes. Include a detailed description of the method of removal of the universal wastes, packaging to prevent damage and release, and in the event of a spill or release, a spill response and clean up plan.
12. Detailed job-specific plan of the work procedures to be used in the removal of hazardous wastes. Include a detailed description of the method of removal of the wastes, packaging to prevent damage and release, waste characterization testing and analysis to include sample collection methods, analytical protocols, and name, qualifications/licenses/registrations of sample collection personnel, analytical laboratory, and in the event of a spill or release, a spill response and clean up plan.

C. Submit to the University's Representative on a daily basis or whenever requested during the progression of the work:

1. Supervisor's daily reports detailing work activities, worker and visitor access problems and corrective actions taken or proposed, injury reports, equipment breakdown, etc.
2. Copies of all transport manifests with actual weight recorded in pounds or weighmasters certificates for all PCB waste materials removed from the control area.

3. Copies of all bill(s) of lading with actual weight recorded in pounds or weighmasters certificates for all fluorescent light tube waste materials removed from the site.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Store all materials at the project site or inside the control area that are subject to damage off the ground away from wet or damp surfaces, and under protective cover to prevent damage or contamination.
- B. Do not use and remove all previously used, damaged and/or deteriorating materials from the premises.
- C. Deliver materials in the original packages, containers, or bundles bearing the name of the manufacturer and brand name.
- D. Utilize UL rated, flame-retardant, polyethylene sheeting.
- E. Utilize “UN1A2” or 17C or 17H lockable “ring top” 55-gallon steel drums for solid (PCB ballast) waste transport, storage or disposal.
- F. Utilize USDOT 17E containers for PCB and/or DEHP liquid waste transport, storage or disposal.
- G. Packing materials capable of preventing damage to fluorescent light tubes during on-site storage and transport to recycler.
- H. Provide signs, labels, warning, and posted instructions that are necessary to protect, inform, and warn people of PCBs and/or DEHPs and fluorescent light tubes.
- I. Provide scaffolds and ladders of sufficient dimension and quantity so that all work surfaces can be easily and safely reached by workers and inspectors. Comply with OSHA requirements when using ladders and scaffolding and incorporate guardrails, midrails, toerails, and wheel locks as required.
- J. Furnish personal protective equipment as necessary:
 1. Disposable coveralls
 2. Chemically resistant gloves
 3. Disposable foot covers (polyethylene)
 4. Chemical safety goggles
 5. Half mask cartridge respirator.
- K. Assemble a PCB/DEHP Spill Kit to include the following items:
 1. Disposable gloves (polyethylene)
 2. Gloves with impermeability to PCBs and DEHPs
 3. Disposable coveralls with impermeability to PCBs and DEHPs
 4. Chemical safety goggles
 5. Disposable foot covers (polyethylene)
 6. PCB Caution Signs: "PCB Spill--Authorized Personnel Only"
 7. Banner guard or equivalent banner material
 8. Absorbent material

9. Blue polyethylene waste bags
10. Cloth backed tape, Brattice cloth, 6' x 6' Rags

2.2 PERSONAL PROTECTIVE EQUIPMENT

- A. Supply all workers, foremen, superintendents, authorized visitors, and inspectors entering regulated control areas with disposable protective clothing consisting of full body coveralls, with head and foot coverings and respiratory protection to prevent exposure to skin or inhalation. Coveralls should be of adequate size and quality to accommodate movement without tearing and to prevent body contamination.
- B. The permissible exposure limit (PEL) for PCBs and/or DEHPs is greater than or equal to 0.5 micrograms per cubic meter ($>0.5 \text{ mg/m}^3$) (fumes from burning) on an 8-hour time weighted average (TWA) basis.
- C. Furnish eye protection such as chemical goggles or face shields, gloves, rubber boots, safety shoes and hard hats as required by job conditions and safety regulations. Rubber boots, safety shoes, and hard hats shall be approved in accordance with ANSI Z89.1 1969 and ANSI Z41.1 1967.
- D. Provide fall arrest equipment in accordance with CFR § 1926.450.
- E. Discard and dispose of all disposable protective clothing into polyethylene bags, or a drum every time the wearer exits from the control area.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review the Contract Documents and perform a pre-construction site investigation to satisfy oneself of the existing conditions affecting the work including:
 1. All Applicable Code Requirements, and University's policies.
 2. Pre-existing damage and areas of repair that will not be the responsibility of the Contractor upon completion of abatement.
 3. The exact quantity of PCBs and/or DEHPs and fluorescent light tubes to be removed and those additional materials likely to be encountered during the course of work. All errors made in estimating, including costs and difficulties, are the sole responsibility of the Contractor, and shall not result in additional expense to the University.
 4. The physical considerations and conditions of both the material and structure. These considerations include any obstacles or obstruction encountered in accessing or removing the material.
 5. The amount and type of equipment needed to complete the job safely.
 6. The availability of utilities.
 7. The handling, storage, transportation, and disposal of the material.

3.2 WORK PLACE ENTRY AND EXIT PROCEDURES

- A. Post the following information outside the control area:

1. Telephone/cellular phone numbers/pager numbers for local hospital, location of hospital and/or emergency personnel, local fire department, University's Representative, and Contractor's Representatives.
 2. Copies of notifications to regulatory agencies as required herein.
 3. Copies of Contractor's SPCC, disposal plan, and injury and illness protection program.
 4. Employee daily sign-in/out log.
 5. Employee/visitor control area entry/exit log.
 6. Cal/OSHA required postings.
- B. Furnish all personnel and authorized visitors throughout the PCB and/or DEHP removal process with the specified protective clothing and gear. Ensure that all personnel entering and leaving the control area abide by the following procedures:
1. Ensure that all personnel, before entering the control area, have read and are familiar with all posted regulations, personal protection requirements (including work place entry and exit procedures), and emergency procedures. Furnish a sign off sheet to acknowledge that these have been reviewed and understood by all personnel prior to entry.
 2. Remove all street clothes and appropriately don personal protective equipment.
 3. Wearing designated personal protective equipment, workers and visitors proceed to the control area.
 4. No smoking, eating, drinking, chewing of gum or tobacco, application of cosmetics, or wearing of jewelry while inside the control area.
 5. Removal of protective clothing prior to leaving the control area.

3.3 REMOVAL AND PACKAGING

A. Electrical Equipment:

1. Obtain University's Representative approval prior to any utility shutdown in accordance with Section 01500 Construction Facilities and Temporary Controls.
2. Provide and maintain all necessary temporary ground fault electrical power service, distribution, equipment, connections, etc., as necessary for the Work. Before final acceptance, remove all temporary equipment and connections installed in a manner approved by University's Representative.
 - a. Do not disturb cables and conductors which may prevent closing of fire-labeled doors.
 - b. Provide ground fault interrupter outlets in order to allow for temporary electric power hook ups.
 - c. Furnish an electrician or electrical subcontractor with a current State of California contractor's C-10 (Electrical-General) license in order to accomplish required electrical hook ups and equipment installations.
 - d. Comply with NEMA, MECA and UL standards and all other applicable electrical code and CAL/OSHA requirements.
3. Temporary Lighting:
 - a. Provide "string type" general service incandescent lighting with guarded cages and portable plug in task lighting of sufficient wattage throughout the control area to supply a 20 foot candle minimum light level.
 - b. Temporary lighting may be used in combination with natural lighting to achieve minimum light level.

- B. Establish a “PCB Control Area” around the PCB items or “DEHP Control Area” around the DEHP items to be removed by roping off the area and posting warning signs at a distance sufficiently far enough away from the control area so as to permit an employee or visitor to read the sign and take the necessary protective measures or avoid entering the area.
- C. Allow only personnel briefed on the handling precautions into the control area.
- D. Ballast Removal and Packaging:
 - 1. Deaden electrical power to fixture and carefully dismantle light fixtures to gain access to remove ballasts.
 - 2. Clip off connecting wires as close as possible to the ballast. Do not bend back ends of ballast.
 - 3. Examine PCB and/or DEHP ballasts to determine if PCB or DEHP oil has leaked, as identified by the presence of a yellow oil on the outside of the ballasts. Segregate leaking from non-leaking ballasts by packaging leaking ballasts in plastic bags.
 - 4. Place leaking and non-leaking ballasts in 55-gallon metal drums. Pack ballasts so as not to cause ballasts to leak.
 - 5. Do not utilize absorbent material or plastic liners in drums.
 - 6. Do not load drums with more than 750 pounds of gross weight.
- E. Universal Waste Removal and Packaging:
 - 1. Deaden electrical power to fixture and carefully remove light tubes to prevent damage or breakage.
 - 2. Package universal wastes in containers that will allow for storage and transport without breaking.
- F. PCB or DEHP Spills:
 - 1. Immediately report to the University’s Representative any PCB or DEHP spills on the ground or in the water, PCB or DEHP spills in drip pans, or PCB or DEHP leaks. In addition, report spills of more than one pound to the National Response Center (1-800-424-8302) and clean up the spill pursuant to 40 CFR §761 Subpart G.
 - 2. Immediately transfer leaking items to a drip pan or other container.
 - 3. Establish a “PCB Spill Control Area” and rope off the area around the edges of the PCB or DEHP leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign.
 - 4. Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery. To clean up spills, wear PPE as specified herein.
 - 5. Mop up the liquid with rags or other conventional absorbent. Containerize and dispose of spent absorbent, mop heads, and rags as solid PCB or DEHP waste.
 - 6. If misting, elevated temperatures or open flames are present, evacuate the area and notify emergency personnel and the University’s Representative.
- G. Broken Fluorescent Light Tubes:
 - 1. Establish a “Mercury Spill Control Area” and rope off the area around the edges of the breakage and post a "Mercury Spill Authorized Personnel Only" caution sign.
 - 2. Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery. To clean up spills, wear PPE as specified herein.

3. HEPA-Vacuum affected area. At conclusion of project include containerized vacuum debris with light tubes to be recycled.

H. Broken Thermometers, Thermostats, Switches:

1. Establish a "Mercury Spill Control Area" and rope off the area around the edges of the breakage and post a "Mercury Spill Authorized Personnel Only" caution sign.
2. Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery. To clean up spills, wear PPE as specified herein.
3. Use spill kit to remove liquid mercury from surfaces.

3.4 CONTRACTOR FURNISHED SAMPLING AND ANALYSIS

- A. Utilize an analytical laboratory to perform sample analysis of PCB and/or DEHP waste characterization samples that is certified by the California Environmental Accreditation Program (CA ELAP).
- B. Conduct representative sampling and analysis of waste streams to determine hazardous waste classification as outlined in Contractor's submittal to meet landfill, 49 CFR 761, and CCR Title 22 requirements.

3.5 STOP WORK ORDER

- A. University's Representative will have the right to issue a Stop Work Order whenever Contractor's work engineering controls, or air monitoring results are not in accordance with published regulations, contractual restrictions, or the abatement specifications. All costs resulting from the Stop Work Order will be at Contractor's expense. Refer to General Conditions Article 2.3.1.
- B. The Stop Work Order shall first be given verbally to Contractor by the University's Representative, at which point all work shall cease. This will be immediately followed by a written notification to stop work. If the situation is not corrected to University's Representative's satisfaction within forty-eight (48) hours, Contractor shall be considered to be in breach of the Contract and shall be subject to termination in accordance with General Conditions Article 13.2.

END OF SECTION

SECTION 07200

BUILDING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide sound insulation as shown on the Drawings and as specified, complete.
- B. Construction Criteria: Sound insulation to prevent equipment or machinery noise from being heard from one room to any other.

1.2 SUBMITTALS

- A. Refer to Division 1 for procedures.
- B. Submit the following:
 - 1. Batt and blanket-type insulation
 - 2. Adhesives
 - 3. Fastening devices
 - 4. Mastic sealer for edge joints and filling voids

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Batt and blanket-type insulation of rock, slag or glass fibrous materials shall conform to ASTM C665 "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings," with the additional requirements that the membrane facing shall have a flame-spread rating not exceeding 25 without evidence of continued progressive combustion, and a smoke-developed rating not exceeding 50. Flame-spread and smoke-developed test procedures shall conform to ASTM E84.
- B. Fastening devices and adhesives shall be as standard with or as recommended by the manufacturer.
- C. Mastic sealer shall be a type recommended by insulation manufacturer for bonding edge joints between units and filling voids in the work.

2.2 ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

A. ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

- 1. Current requirement refers to the date on which the materials are installed in the building.

2. Interior refers to all building construction that is inside of the exterior weatherproofing material.
3. Refer to <http://www.aqmd.gov/rules> for the actual current version of SCAQMD Rule #1168 that will be applicable at the date of installation during construction.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Install insulation where shown on the Drawings and according to manufacturer's printed recommendations. Remove and replace damaged insulation as approved and at Contractor's expense.

END OF SECTION

SECTION 07840

FIRE STOPS AND SMOKE SEALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire Stops and smoke seals.
2. Mineral fiber insulation fire safing.
3. Damming material, clips, and closures.

B. Related Sections:

1. See comment in Section 07200: Building Insulation.
2. Section 09250: Gypsum Board.

1.2 SYSTEM DESCRIPTION

- A. Provide fire stops and smoke seals to prevent the passage of fire, smoke, toxic gasses or water from one floor or area to another. Seal openings in floors, fire rated walls and permanent partitions penetrated by pipes, ducts, conduits and other items as shown, specified, and as required for the type of construction.
- B. Mineral fiber insulation installed as fire safing at non-rated penetrations not containing pipes, ducts, conduits, and other items in floor slabs, wall partitions, construction-joint conditions between slabs and adjacent construction and where indicated or required.
- C. Provide damming material, clips, and closures as required for support and containment of dams, and other insulation materials required for tested and rated fire stop systems.

1.3 QUALITY ASSURANCE

A. Performance Criteria:

1. Provide materials and Work to conform to source quality control criteria specified herein and CBC requirements in fire resistant wall and floor assemblies to prevent the passage of fire, smoke, and toxic gases.
2. Installed fire stops shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.

- B. Comply with 2007 CBC requirements for fire rated construction.

- C. Qualifications of Manufacturer: Products furnished for fire stopping and smoke seals shall be manufactured by a firm which has been continuously and regularly employed in the manufacture of these materials for a period of at least 5 years; and which can furnish evidence of these materials being satisfactorily installed on at least 5 projects of similar size and type within such period.
- D. Qualifications of Installer: The Work of this section shall be installed by a firm which has been in the business of installing similar materials for at least 5 consecutive years; and can furnish evidence of satisfactory completion of 5 projects of similar size and scope. Installer shall have applicators trained and certified by manufacturer for performing this Work.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's Product Data for each type of fire stop and smoke seal material proposed for installation. Indicate product characteristics, typical installations, performance, and limitation criteria and test data.
 - 2. Submit manufacturer's printed installation instructions for each type of product, system, and construction required for the Work. Indicate fire resistance rating of each installation.
 - 3. Submit fire test reports from independent testing agency indicating the following:
 - a. Fire test report of fire stop material installed to substrate and penetration materials similar to the Work of this section. Test to indicate both Flame (F) and Temperature (T) Ratings.
 - b. Test reports of products to be installed shall indicate conformance to ASTM E 814, UL rating with UL classified system description, and UL classified system detail.
- B. Field Samples: No less than 10 days before commencing the Work of this section, provide field installed Samples of fire stop materials and systems.
 - 1. Apply one Sample of fire stop material for each different penetration and related fire rating required for the Work.
 - 2. Sample areas shall comply with thickness, fire resistance ratings, and finished appearance.
- C. Manufacturer's Qualifications: Submit evidence of conformance with qualification requirements specified above.
- D. Installer's Qualifications: Submit evidence of conformance with qualification requirements specified above.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the Project site in manufacturer's original, unopened containers bearing correct UL labeling.
- B. Fire stop material shall be stored above grade in an area protected from detrimental weather and moisture conditions.

- C. Fire stop and seal materials shall be installed before expiration of shelf life.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Unless otherwise noted, products of this section shall be as manufactured by Bio Fireshield Inc.(Bio), Concord, Massachusetts; 3M Fire Protection Products; General Electric (GE); or Nelson Electric, Tulsa, Oklahoma 74101; or equal.
- B. Provide materials and systems of specified manufacturers to suit penetration and substrate as determined by various conditions of installation.

2.2 MATERIALS

- A. Fire Stop Sealant: Single component, noncombustible fire stop sealant Biotherm "S" gun grade, or Biotherm "T" self leveling silicone by Bio, Pepsi 100 by GE, CP25WB by 3M, or equal.
- B. Fire Stop Putty: One-part intumescent type FSP by Nelson, MPS/MPP by 3M, or equal.
- C. Cementitious Fire Stop Mortar: Novasit K-10 (55 lb. density) by Bio, 3M mortar by 3M, or equal. Cementitious mortar shall be non-shrinking, asbestos free type.
- D. Fire Stop Pillows: Manufactured by Bio Fireshield, Nelson, or equal.
- E. Fire Safing, Mineral Fiber or Ceramic Wool Non-Combustible Insulation:
 - 1. Mineral Fiber: Density 4 pounds per cubic foot, USG Thermafiber, Fibrex "FBX Safing Insulation," or equal.
 - 2. Ceramic Wool: Density 6 pounds per cubic foot, Johns Manville "Ceramic Fiber Insulation", Carborundum "Fiberfrax" ceramic fiber, or equal. Provide material in tested thickness for required hour rating.
 - a. Flame Spread: 0.
 - b. Smoke developed: 0.
 - 3. For mineral fiber, provide 20 gage minimum size metal retainer clips and plates for fire safing support in vertical applications and in compliance with tested rating.
- F. Supplemental Material: Provide supplementary materials required for complete, fire rated, installation.

2.3 SOURCE QUALITY CONTROL

- A. Fire stop and smoke seal material shall be tested by an independent testing agency for conformance to Flame (F) and Temperature (T) requirements of ASTM E-814/UL 1479.
- B. Conform to UL Fire Hazard Classification Requirements. Material shall be classified as a fill, void, or cavity material and system for UL Through Penetration Firestop System. Comply with UBC 43-6.
- C. Material shall be tested and classified noncombustible per ASTM E 84.

2.4 ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

A. ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

1. Current requirement refers to the date on which the materials are installed in the building.
2. Interior refers to all building construction that is inside of the exterior weatherproofing material.
3. Refer to <http://www.aqmd.gov/rules> for the actual current version of SCAQMD Rule #1168 that will be applicable at the date of installation during construction.

PART 3 - EXECUTION

3.1 APPLICATION REQUIREMENTS

- A. Provide single component, noncombustible, fire stop sealant or putty. Within penetrations subject to movement including conduit, cable bundles, buss duct, and noncombustible pipe.
 1. As a sealant or caulking for smoke barrier construction, fire, and smoke dampers, mechanical/electrical framed elements in masonry and gypsum board partition systems, and other conditions.
- B. Provide mineral fiber insulation for fire safing at joints and openings through floor slabs, walls, and partitions not indicated to be grouted, gaskets, sealed or otherwise made sound or air tight in this or other sections. Fire safing shall be packed and wedged solidly from both sides of walls and partitions, and from both top and bottom sides of slabs with noncombustible mineral fiber insulation.

3.2 PREPARATION

- A. Examine the areas and conditions where fire stops and smoke seals are to be installed for conditions detrimental to the proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected for rated fire protection.
- B. Surface to receive fire stops or smoke seals shall be free of dirt, dust, grease, form release agents, or other matter that would impair the bond of the fire stop material to the substrate or penetrating items. Substrate shall be frost free and when required, dry.
- C. Voids and cracks in substrate shall be filled and unnecessary projections removed before installation of fire stops.
- D. Penetrating items shall be permanently installed before fire stop and smoke seal installation.
- E. Assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed before installation of fire stops. Schedule and sequence the Work to assure that partitions and other construction, which would conceal penetrations, are not installed before the installation of fire stops and smoke seals.

3.3 INSTALLATION

- A. General: Provide installation in accordance with manufacturer's installation procedures, as required. Install fire stops in accordance with fire test reports, UL fire resistance requirements, and reviewed Sample installations.
- B. Dam Construction:
 - 1. Install dams when required to properly contain fire stopping materials within openings and as required to achieve fire resistance rating as tested and rated.
 - 2. Provide in conformance with installation requirements for type of floor, wall, and partition construction, and as recommended by fire stop manufacturer.
 - 3. Combustible damming material shall be removed after appropriate curing. Noncombustible damming material may be left as a permanent component of the fire stop system.
 - 4. Placement of dams shall not interfere with function, or adversely affect the appearance, of adjacent construction.
- C. Installation of Single Component Fire Stop Sealant:
 - 1. Provide noncombustible insulation as required to achieve fire resistance rating.
 - 2. Install with manual or powered caulking gun. For up to 3 hour rating, install in 1/2 inches total thickness to both sides of wall penetrations, and to one side in floor penetrations.
 - 3. Surface of gun grade fire stop sealant shall be tooled with clean potable water.
 - 4. Remove excess materials from adjacent surfaces within 10 minutes, with either water or other material compatible with sealant and recommended by sealant manufacturer, leaving the Work in a neat, clean condition.
- D. Installation of Cementitious Fire Stop Mortar:
 - 1. Mixing: Add dry powder to water and mix with mechanical mixer or hand mixing tools. Ratio and duration of mix shall be as instructed by fire stop mortar manufacturer. Average wet density of mortar shall be 70 pounds per cubic foot (+/- 5).
 - 2. Wet surfaces before installation of fire stop mortar. Mortar may be hand installed or pumped into the opening.
 - 3. When installing around layered and/or grouped cables, vibrate or move the cables slightly to prevent voids from forming between the cables.
 - 4. Exposed surfaces shall be finished with conventional plastering tools before curing.
 - 5. Allow at least 48 hours for initial cure before form removal. For full cure allow 27 days.

3.4 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.5 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07900

SEALANTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Clean and prepare joint surfaces.
- B. Sealant and backing materials.
- C. Minimum locations for caulking:
 - 1. Acoustical ceiling system to gypsum board.
 - 2. Perimeters of door, frame to plaster or gypsum board.
 - 3. All locations where gap between finish materials exceeds 1/16", and other locations shown on drawings.

1.2 RELATED WORK

- A. Not applicable.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 834 — Latex sealants.
 - 2. ASTM C 920 — Elastomeric joint sealants.
 - 3. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- B. Federal Specifications (FS):
 - 1. FS-TT-S-230 - Sealing Compounds, Synthetic-Rubber Base, Single Component, Chemically Curing.
 - 2. FS TT-S-1543 - Sealing Compound, Silicone Rubber Base.

1.4 QUALITY ASSURANCE

- A. Shelf Life: Do not use materials whose shelf life has expired.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver sealant materials in manufacturer's original sealed containers. Store and handle to prevent damage.

1.6 JOB CONDITIONS

- A. Environmental Requirements: Follow manufacturer's printed recommendations for temperature range, humidity, moisture content of surfaces, and ventilation.
- B. Sequencing, Scheduling: Schedule work to seal various portions of the work, as it progresses.

1.7 ALTERNATIVES

- A. Contractor may, at his option and expense, select anyone, but only one, of the specified sealant materials for use throughout the project.

1.8 WARRANTY

- A. Furnish to University a written guarantee for Sealants against all defects in materials and workmanship, including against loss of cohesion or adhesion, or do not cure, for a minimum of (2) two years from date of acceptance. Refer to Section 01740 for submittal form.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

- A. Sealant: Polysulphide base, single component, chemical curing; conforming to requirements of FS TT-S-230, Type II, Class A; Shore A hardness of minimum 15 and maximum 50; non-staining and non-bleeding; color as selected by the University's Representative to match adjacent surfaces.
- B. Sealant: Silicone base, single component, solvent curing; conforming to requirements of FS TT-S-1543, Class A; Shore A hardness of maximum 50; non-staining; color as selected by the University's Representative to match adjacent surfaces.
- C. Sealant: Acrylic base, single component, solvent curing; conforming to requirements of FS TT-S-230, Type II, Class A; Shore A hardness of maximum 55; non-staining; non-bleeding; non-sagging; color as selected by the University's Representative to match adjacent surfaces.

2.2 ACCESSORIES

- A. Primer: Non-staining type, as recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-Corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Filler: ASTM D 1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.3 ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

A. ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

- 1. Current requirement refers to the date on which the materials are installed in the building.

2. Interior refers to all building construction that is inside of the exterior weatherproofing material.
3. Refer to <http://www.aqmd.gov/rules> for the actual current version of SCAQMD Rule #1168 that will be applicable at the date of installation during construction.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify joint dimensions, physical, and environmental conditions are acceptable to receive work of this Section.
- B. Beginning of installation means acceptance.
- C. Do not start work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter, which might impair adhesion of sealant.
- B. Verify that joint shaping materials and release tapes are compatible with sealant.
- C. Examine joint dimensions and size materials to achieve required width/depth ratios.
- D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- E. Use bond breaker where required.

3.3 INSTALLATION

- A. Perform work in accordance with ASTM C 920 for elastomeric joint sealants, and C 834 for latex base sealants.
- B. Install sealant in accordance with manufacturer's instructions for a consistent width and depth.
- C. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
- D. Tool joints concave or as indicated, in a smooth, uniform width.
- E. Joints: Free of air pockets, foreign embedded matter, ridges, and sags.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes steel doors, welded steel door frames and knock down steel door frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 08710 - "Finish Hardware"
 - 2. Section 08211 – "Flush Wood Doors"
 - 3. Section 09250 - "Gypsum Wallboard"
 - 4. Section 09900 - "Painting"

1.2 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified
- B. Fire Doors shall have the minimum opening force allowable by the California Fire Marshal, not to exceed 15 lbf (66.7N).

1.3 SUBMITTALS

- A. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- B. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- C. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to University's Representative; otherwise, remove and replace damaged items as directed.

- C. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products by one of the following:

- 1. Welded Steel Door Frames:
 - a. Door Components, Inc.
 - b. Curries.
 - c. Steelcraft; an Ingersoll-Rand Company.
 - d. Or equal.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Supports and Anchors Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M
- C. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 FRAMES

- A. Provide metal frames for doors, transoms, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch- thick cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners, continuously welded construction for exterior applications.
 - 2. Fabricate exterior frames for openings over 48 inches wide from 0.0635-inch thick steel sheet.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Plaster Guards: Provide minimum 0.0179-inch- thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.4 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - 1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
 - a. Resin-impregnated paper honeycomb.
 - b. Rigid polyurethane conforming to ASTM C 591.
 - c. Rigid polystyrene conforming to ASTM C 578.
 - d. Unitized steel grid.
 - e. Vertical steel stiffeners.
 - f. Rigid mineral fiber with internal sound deadener on inside of face sheets.
 - 2. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between non-fire-rated pairs of doors. Not more than 3/4 inch at bottom.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- F. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- G. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- H. Glazing Stops: Minimum 0.0359-inch- thick steel or 0.040-inch- thick aluminum.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to doors and frames after fabrication.

2.6 STEEL SHEET FINISHES

- A. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
 1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel door frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 2. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
 3. In in-place gypsum board partitions, install knock-down, slip-on, drywall frames.
 4. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb: install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
- C. Door Installation: Fit doors accurately in frames, within clearances specified in ANSI/SDI 100.
- D. Welded Steel Frames Installation:
 1. Install frame solid in the wall, plumb and square, with proper opening width and height.

2. Fasten clip angles to floor construction and brace frames so as to retain their position and clearance during construction of adjacent work.
 3. Install anchors for connection to concrete, at each jamb for each 2-feet 6-inches of height or fraction thereof, starting at 12-inches above the finished floor (minimum 3 per jamb).
 4. Install anchors for stud partitions on hinge jamb immediately above each hinge reinforcing plate and below the top hinge reinforcement (minimum 4 per jamb) and locate anchors directly opposite on the strike jamb.
- E. Doors Installation, General: Hang doors and adjust for proper clearances and operation. Refer to Section 08710- "Finish Hardware" for hardware requirements.
- F. Door Installation Tolerances: Fit doors accurately in frames, within clearances specified in ANSI/SDI-100.
- H. Vision Lights Installation: Confirm to manufacturer's instructions, including requirements for fire rated installations.
- 3.2 ADJUSTING AND CLEANING
- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 08211

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Section 01400 "Quality Control"
 - 2. Section 08110 "Steel Doors and Frames"
 - 3. Section 08710 "Finish Hardware"

1.2 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.
 - 1. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate fire ratings for fire doors.
- C. Samples for Verification: As follows:
 - 1. Corner sections of doors approximately 8 by 10 inches (200 by 250 mm) with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with the following standard:
 - 1. Millwork, casework and cabinetwork shall be manufactured in accordance with standards established in the Manual of Millwork of the Woodwork Institute (WI) 2009 edition in the grade or grades specified herein or as shown on drawings. If the manufacturer is not a WI licensee, Contractor shall furnish to University's representative, prior to installation, a

Certificate of Reinspection by the WI indicating that the work in question meets the requirements of the WI grade specified. If the manufacturer is a WI licensee, each elevation of work shall bear the WI Certified Compliance grade level indicating the grade specified, and by the completion of the job, WI Certified Compliance Certificates shall have been issued certifying that the installation fully meets the requirements for the grade specified. The foregoing shall not be construed to limit the power and authority of the University's Representative to reject any millwork which does not in University's Representative's opinion meet with any one or more of the specifications of this contract.

- a. Furnish WI Certified Compliance Certificate indicating that doors meet requirements of grades specified.
 - b. Furnish WI Certified Compliance Certificate for installation.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- D. Fire Doors shall have the minimum opening force allowable by the California State Fire Marshal, not to exceed 15 lbf (66.7N).

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.
1. Comply with WI's Technical Bulletin 420-R for delivery, storage, and handling of doors.
- B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.6 WARRANTY

- A. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not comply with tolerances in referenced quality standard.
1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by one of the following:

1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Buell Door Co.
 - c. Eggers Industries; Architectural Door Division.
 - d. Weyerhaeuser.
 - e. Or equal.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish: Comply with the following requirements:

1. Grade: Premium, with Grade AA White Oak faces.
2. Faces: .70 mm thick, composite veneer adhered to solid particle board (mineral core at rated conditions), 5 - ply construction, 1 - 3/4 inches thick, WIC Type I adhesive. Substrate to meet WIC Section 20 Figures 1 & 6. Vertical grain maple with clear stain finish to match existing adjacent door veneer faces.
3. Pair and Set Match: Provide for pairs of doors and for doors hung in adjacent sets.
4. Stiles: Same species as face or a compatible species.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-1.
2. Blocking: Provide wood blocking at particleboard-core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, at doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, at exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch (125-mm) midrail blocking, at doors indicated to have exit devices.

B. Interior Veneer-Faced Doors: Comply with the following requirements:

1. Core: Particleboard core.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors: Comply with the following requirements:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as required to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated and as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, at doors indicated to have kick, mop, or armor plates.
 - c. 4-1/2-by-10-inch (114-by-250-mm) lock blocks.
 - d. 5-inch (125-mm) midrail blocking, at doors indicated to have exit devices.
 - e. As necessary to eliminate need for through-bolting hardware.
 3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
 4. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
- D. Composite wood and agri-fiber products must contain no added urea formaldehyde resins.

2.4 FABRICATION

- A. Fabricate flush wood doors in sizes indicated for Project site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-rated doors.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard's requirements for factory finishing.
- B. Finish wood doors at factory.
- C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
 1. Grade: Premium
 2. Finish: WI System #3a catalyzed lacquer
 3. Staining: Match existing adjacent door finishes and University's Representative sample

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08710 "Finish Hardware."
- B. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at Project site.

3.3 ADJUSTING AND PROTECTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for wood doors.
 - 3. Door hardware for other doors indicated.
 - 4. Keyed cylinders as indicated.
- B. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.

1.2 SUBSTITUTIONS:

- A. Comply with Division 1

1.3 SUBMITTALS:

- A. Comply with Division 1
 - 1. Statement of qualification for distributor and installers.
 - 2. Statement of compliance with regulatory requirements and single source responsibility.
- B. Special Submittal Requirements: Combine submittals of this Section to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- C. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
 - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - 4. Submit 6 copies of catalog cuts with hardware schedule.
- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
 - 1. List groups and suffixes in proper sequence.

2. Completely describe door and list architectural door number.
 3. Manufacturer, product name, and catalog number.
 4. Function, type, and style.
 5. Size and finish of each item.
 6. Mounting heights.
 7. Explanation of abbreviations and symbols used within schedule.
 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples:
1. 1 sample of Lever
 2. 3 samples of metal finishes
- G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated. Operating and maintenance manuals:
1. Submit 3 sets containing the following.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 2. Copy of final hardware schedule, edited to reflect, "As installed".
 3. Copy of final keying schedule
 4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
 5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

- A. Comply with Division 1.

1. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
 2. Installer's Qualifications: Firm with 3 years experience in installation of similar hardware to that required for this Project, including specific requirements indicated.
 3. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 4. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the University's Representative in writing and furnish hardware in compliance with the Specification approved by University's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1 of Specification Section.
1. Deliver products in original unopened packaging with legible manufacturer's identification.
 2. Package hardware to prevent damage during transit and storage.
 3. Mark hardware to correspond with "reviewed hardware schedule".
 4. Deliver hardware to door and frame manufacturer upon request.
- B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 GUARANTEE:

- A. Refer to General Conditions of the Contract
- B. Furnish to University a written guarantee for Closers against all defects in materials and workmanship for 10 years from date of acceptance. Refer to Section 01740 for submittal form.
- C. Furnish to University a written guarantee for Locksets & Cylinders against all defects in materials and workmanship for 3 years from date of acceptance. Refer to Section 01740 for submittal form.
- D. Furnish to University a written guarantee for all other hardware against all defects in materials and workmanship for 2 years from date of acceptance. Refer to Section 1740 for submittal form.

1.8 UNIVERSITY INSTRUCTION:

- A. Instruct University personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Materials: Deliver to University extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
 - 1. Quantity: Furnish quantity of full-size units equal to 5% of amount installed.
 - 2. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 3. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 - 4. Delivery, Storage and Protection: Comply with University requirements for delivery, storage and protection of extra materials.
- B. Maintenance Service: Submit for University consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Provide products by the following listed manufacturers or equal:

Item:	Manufacturer:	2nd Listed Manufacturer:
Hinges	(IVE) Ives	Bommer
Continuous Hinges	(IVE) Ives	Pemko
Pivots	(IVE) Ives	Rixon
Floor Closers	(RIX) Rixon	Dorma
Key System	(SCH) Schlage	
Locks	(SCH) Schlage	

Exit Devices	(VON) Von Duprin,	
Closers	LCN	Ryobi
Pulls	(IVE) Ives	Rockwood
Stops	(IVE) Ives	Rockwood
Overhead Stops	(GLY) Glinn-Johnson	
Seals and Bottoms	(NGP) NGP	Zero

2.2 MATERIALS:

A. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush [concealed] bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish.
9. UL10B listed for Fire

B. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra- Heavy Duty, Security Grade 2 and be UL10C
2. Fit ANSI A115.1 door preparation
3. Functions and design as indicated in the hardware groups
4. Two-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
6. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated

8. Provide sufficient curved strike lip to protect door trim
9. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
10. Lock shall have self-aligning, thru-bolted trim
11. Levers to operate a roller bearing spindle hub mechanism
12. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset.
13. Spindle to be designed to prevent forced entry from attacking of lever
14. Each lever to have independent spring mechanism controlling it
15. Cylinder face must be the same finish as the lockset 16. Functions and design as indicated in the hardware groups

C. Cylindrical Type Locks and Latchsets:

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra- Heavy Duty, and be UL 10C listed
2. Fit modified ANSI A 115.2 door preparation
3. Locksets to have anti-rotational studs that are thru-bolted
4. Keyed lever shall not have exposed "keeper" hole
5. Each lever to have independent spring mechanism controlling it
6. 2-3/4 inch (70mm) backset
7. 9/16 inch (14mm) throw latchbolt
8. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
9. Keyed lever to be removable only when lockset is in the unlocked position.
10. Hub, side plate, shrouded rose locking pin to be a one-piece casting with a shrouded locking lug.
11. Locksets outside locked lever must withstand a minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset
12. Cylinder face must be the same finish as the lockset 13. Functions and design as indicated in the hardware groups

D. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. ULIOC certified

3. Closer shall have extra-duty arms and knuckles
4. Conform to ANSI 117.1
5. Maximum 2 7/16 inch case projection with non-ferrous cover.
6. Separate adjusting valves for closing and latching speed, and backcheck
7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
8. Full rack and pinion type closer with 1 1/4" minimum bore
9. Mount closers on non-public side of door, unless otherwise noted in specification 10. Closers shall be non-handed, non-sized and multi-sized I through 6
- E. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish pan-head countersunk screws to match finish.
- F. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- G. Key Control: Provide one wall mounted key cabinet complete with Velcro hooks, index and tags. In addition provide one set of software for key management.
- H. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- I. Sweep period of closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75mm) from the latch, measured to the leading edge of the door.

2.3 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.5, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

- A. Provide keyed construction cylinders and keys during the construction period. Construction and operating keys and cylinders shall not be part of the University's permanent keying system or furnished in the same keyway (or key section) as the University's permanent keying system. Permanent cylinders and keys (prepared according to the accepted keying schedule) will be furnished to the University.
- B. Cylinders: All cylinders shall be keyed to the existing Schlage University key system.

- C. Permanent keys: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to University's Representative by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. (1) each Grand Masterkeys
 - 2. (4) each Masterkeys
 - 3. (2) each Change keys each cylinder
 - 4. (15) each Construction masterkeys
- F. The University will install permanent cylinders and return the construction cylinders to the Hardware Supplier. Construction cylinders and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with University's Representative and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to University's Representative.

PART 3 — EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. ADA Standard: Conform to ANSI A 117.1 for positioning requirements for disabled.
- C. Install hardware using the manufacturer's fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
1. Check and adjust closers to ensure proper operation.
 - a. Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds. "Sweep" period from 70% open to 3" from latch shall be no less than 3 seconds.
 - b. Adjust "Backcheck" according to manufacturer's instructions.
 - c. Set interior non-rated at 5 lbs, rated openings at 12 lbs
 2. Check latchset and lockset are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 3. Report findings, in writing, outlining corrective actions and recommendations.

3.5 SCHEDULE OF FINISH HARDWARE:

- A. Manufacturer's Abbreviations:
1. IVE H.B. Ives
 2. LCN LCN Closers
 3. SCH Schlage Lock Company
 4. NGP National Guard Products
 5. GLY Glynn-Johnson Hardware

3.6 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.

Heading 01

1 SGL DOOR32-045 HALL / NEW TI

Each Assembly to have:

3	EA	HINGE	3CB1 4.5 X 4.5	630	IVE
1	EA	CLASSROOM LOCK	L9077T 17A	630	SCH
1	EA	MORTISE CYLINDER	TO MATCH EXISTING BLDG STANDARD	626	SCH
1	EA	CORE ONLY	TO MATCH EXISTING KEYING	626	B/O
1	EA	SURFACE CLOSER	4041 DEL	689	LCN
1	EA	10" KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP & HOLDER	FS41	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

Heading 02

1 SGL DOORA3-043A HALL / MAINT OFFICE

Each Assembly to have:

3	EA	HINGE	3CB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9080T 17A	630	SCH
1	EA	MORTISE CYLINDER	TO MATCH EXISTING BLDG STANDARD	626	SCH
1	EA	CORE ONLY	TO MATCH EXISTING KEYING	626	B/O
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP & HOLDER	FS41	626	IVE
1	SET	SEALS	5050CL	CLR	NGP

Heading 03

1 SGL DOOR73-045 HALL / CLASSROOM

Each Assembly to have:

3	EA	HINGE	3CB1 4.5 X 4.5	630	IVE
1	EA	CLASSROOM LOCK	L9077T 17A	630	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
1	EA	CORE ONLY	23-030	626	SCH
1	EA	FLOOR STOP & HOLDER	FS41	626	IVE
1	SET	SEALS	5050CL	CLR	NGP

Heading 04

1 SGL DOOR73-145A HALL / IT

1 SGL DOORBO-135HALL / TELCO

Each Assembly to have:

3	EA	HINGE	3CB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9080T 17A	630	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
1	EA	CORE ONLY	23-030	626	SCH
1	EA	OVERHEAD HOLDER	900F	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 09100

COLORS & MATERIALS

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Related Work of Other Sections: Coordinate the Work of this Section with the Work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the Work of other Sections.

1.2 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION:

- A. This Section designates selection of materials, color and finish of exposed surfaces for interior work indicated.

1.3 QUALITY ASSURANCE:

- A. All installed Work shall match submitted control samples. Prior to submittal, Contractor shall verify that adequate matching material exists to complete job.

1.4 REFERENCES:

- A. Refer to individual Sections for specific references.

1.5 SUBMITTALS:

- A. Comply with the following:
 - 1. Color selections are subject to revision by University's Representative upon review of actual samples prepared by supplier showing color and finish.
 - 2. Samples of materials supplied as yard goods shall be submitted as not less than 12" square memo sample, but in no case less than one full repeat of the pattern.
 - 3. Paint colors shall match those shown in this schedule and are to be submitted on 12" by 12" panels of the same material used in the project for preliminary review by the University's Representative. Submit three display panels of each color, finish and type shown in the schedule. For paint colors designated for drywall application, submit on 1/4" thick drywall with taped edges. Final submittal of drywall paint colors shall be as a field sample after approval of display panels. Field samples shall be in location as designated on the Drawings or at the direction of the University's Representative. Field samples shall be a minimum of 3'-0" wide by full height and shall be in area with final project light fixtures in place and functioning. Do not proceed with related Work until approval of field samples.
 - 4. Submit actual samples of devices such as light switches, sprinkler heads, ionization detectors, fire alarm pulls and similar devices complete with appropriate escutcheons or cover plates and anchors for University's Representative approval of color and finish.

5. Control samples are available for review at University's Representative office and Contractor shall be responsible to ensure that samples submitted and actual product installed conform with control samples for color, appearance, gloss, sheen and finish.

1.6 DELIVERY. STORAGE AND HANDLING:

- A. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class, grade, size and color.
- B. Storage of Materials: Store materials in unopened containers. Store off ground and under cover, protected from damage. Do not store rolled goods in upright position.

PART 2 - PRODUCTS

2.1 GENERAL NOTES:

- A. Miscellaneous painted items not otherwise shown in the Contract Documents or schedules below shall to be painted to match the adjacent surface.
- B. Sealants and grout shall, in general, to match finished surfaces between which they are exposed to view. Where finish materials change color, sealant and grout color transition shall be as approved by University's Representative. Refer to Section 07900 "Sealants."
- C. All doors as indicated to receive paint shall be finish C unless otherwise noted. All frames as indicated in University's Representative door schedule to receive paint shall be finish C unless otherwise noted in this schedule. Where rooms change color the door transition color shall occur as approved by University's Representative.
- D. Doors and door frames exposed to designated lease space to be finished with manufacturer primer only.
- E. All gypsum board and ceramic tile walls exposed to wet locations and all plumbing walls to be water resistant gypsum board. Refer to Section 09250 "Gypsum Wallboard."
- F. Paint access covers to match adjacent surfaces unless noted otherwise.
- G. Provide white electrical devices and face plates, ionization detectors, life safety and paging speakers, and metal ceiling trim to be match ceiling color when exposed to view unless noted otherwise.
- H. All exposed mechanical louvers, grilles, etc., are to be painted to match adjacent surfaces unless noted otherwise.
- I. Resilient base to be 4" straight base at carpet areas, 4" cove base at hard surface materials such as VCT unless noted otherwise.
- J. Adjustable shelving and miscellaneous painted millwork color to match wall surface in which it occurs unless noted otherwise.
- K. Paint diffusers to match adjacent surfaces. Paint blackout panels at non-active lengths of slot diffusers and sight baffles at returns matte black.
- L. Paint surface mounted closer covers to match door.
- M. Paint exposed base building core doors and frames to match wall in which they occur.

2.2 COLOR AND FINISH SELECTION KEY:

A. COLOR SELECTION KEY:

1. KEY COLOR TO MATCH

- a. Dunn Edwards, Color: See Color Selection on the plan.
- b. Sinclair, Color: To be selected.
- c. Frazee, Color: To be selected.

B. FINISH SELECTION KEY:

KEY	SHEEN	GEO./ DEGREE	PAINT GLOSS RANGE	FINISH TYPE TO BE AS LISTED HERE UNLESS NOTED OTHERWISE
A.	Flat	85	Below 15	Painted exposed concrete
B.	Eggshell	60	5 to 20	Painted drywall, plaster
C.	Semi-gloss	60	30 to 65	Painted hardboard in BO-143 Room where noted and metal door frame.
D.	Gloss	60	Over 65	Millwork/metal, where noted.

2.3 MATERIALS SELECTION KEY

A. Materials are Scheduled on the Drawings.

B. PAINT (Section 09900)

1. P-1 Paint to match color 1
2. P-2 Paint to match color 1

C. RESILIENT BASE (Section 09658)

1. B-1 Burke 4" Rubber Wall Base, or equal. Color: As selected by University's Representative.

D. SUSPENDED CEILING SYSTEM (Section 09511)

1. ACT-1 Tile: Armstrong Cortega 747 or Equal. Grid: Armstrong 15/16" exposed Tee Prelude ML or equal

E. VINYL COMPOSITION TILE (Section 09677)

1. VCT-I Armstrong, SDT Static Dissipative Tile or Equal.

END OF SECTION

SECTION 09211

PLASTER RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Cutting out and removing existing interior plaster where indicated on Contract Drawings, where specified, and where needed to repair existing cement or gypsum.
 - 2. Repair and patching of all cracks, spalls, delaminations, breaks, losses, chips, holes and other defects in cement or gypsum plaster surfaces.
 - 3. Furnishing and installing new plaster as indicated on the Contract Drawings.
 - 4. Furnishing and installing accessories and associated Work, including new steel studs, channels, and lath where required.
 - 5. The Work in this section applies to the following items noted on the drawings:
 - a. Interior Plaster Wall Finish
 - b. Interior Plaster Ceiling
- B. Related Sections:
 - 1. Section 09900 "Painting"

1.2 QUALITY ASSURANCE

- A. Applicator shall have not less than ten (10) years successful experience in comparable plaster restoration projects and employing only skilled journeyman plasterers who are skilled in the restoration processes and operations indicated. Written proof of qualifications shall be furnished when requested by the University's Representative.
- B. Pre-Construction Conference: Prior to the start of the Work, there shall be a pre-construction conference among the following parties: Architect, Contractor, Applicator, and University's Representative to review requirements and procedures. The conference shall include a walk-through of the job-site as required.
- C. Codes and Standards:
 - 1. Cement plaster work shall conform to ASTM C 1063 and ASTM C926; and Gypsum plaster work shall conform to ASTM C841 and ASTM C842; except where more stringent standards are specified.
 - 2. Contractor to require observance of LADBS, California State and OSHA regulations and precautions.
- D. Allowable Tolerances: All plaster repairs shall be keyed and feathered to exactly match and continue edges and contours of existing plaster work. Repairs when cured shall be true and flat in connection with adjacent surfaces when checked with an 8 ft. straight edge; do not exceed 1/8 inch variation in 10 ft. for bow, warp, plumb, or level for flat and curved surfaces.

- E. Defects: Plastering with defects of such character as will mar the appearance of finished work, or which otherwise defective, shall be rejected, removed and replaced at the Contractor's expenses.

1.3 SUBMITTALS

A. Statement of Qualifications:

1. List of recently completed projects including project name, location, name of Owner and Architect and description of work and products used.
2. Certification that applicator is experienced in the application of the specified products.

- B. Inspection Report: New cement plaster shall not be used in contact with existing gypsum plaster and new gypsum plaster shall not be used in contact with existing cement plaster. Areas designated as cement or gypsum plaster shall be confirmed by the Contractor prior to start of the Work and the Contractor shall report his findings to the University's Representative in writing. The Contractor shall make adjustments in materials, as required to install either gypsum or cement plaster in accordance with the requirements of this sub-paragraph.

- C. Product Data: Submit manufacturer's product data for cementitious materials, lath, metal support components and accessories; including manufacturer's current recommendations as to methods and installation.

- D. Protection Plan: Describe methods for protecting surrounding areas, building occupants, pedestrians, vehicles and surfaces during the work from contact with potential sources of damage.

- E. Schedule of Work: Submit schedule of work, including all required mock-ups and submittals and execution steps.

- F. Samples: Submit, prior to mock-up erection, samples of the following:

1. Each accessory, 8" x 8" or 12" long as appropriate, to be used in the Work.
2. Sample panels, 24" x 24", of each type of plaster.

- G. Maintenance Instructions: After the Work is complete, maintenance instructions shall be submitted for the Work covered in this Section. These instructions will include recommended routine cleaning materials, procedures, and schedule, to be carried out by the maintenance staff. The instructions shall be submitted at 80% completion and in a 3-ring binder for approval. Submit final report at 100% completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

- B. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes. Neatly stack gypsum lath flat to prevent deformation.

- C. Handle gypsum lath to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after application of plaster.

- B. Cold Weather Protection: When ambient outdoor temperatures are below 45 deg. F., maintain continuous uniform temperature of not less than 45 deg. F. nor more than 80 deg. F. for not less than one (1) week prior to beginning plaster application, during its application, and until plaster is dry but not less than one week after application is complete. Distribute heat evenly; prevent concentrated or uneven heat from contacting plaster near heat source.
- C. Ventilation: Ventilate building spaces in compliance with ASTM C 842 and as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
- D. Lead Based Paint: Painted plaster may contain lead-based paint. Where paint surface is to be disturbed, as in digging out cracks and other procedures, use approved lead-based paint abatement products, equipment, and procedures. Provide adequate environmental and worker protection.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Where specified products or other items are not available, furnish products which are equal to original specifications, as approved by the University's Representative.
- B. Materials shall be new of the highest grade, free from defects, or recent manufacture and shall conform to the requirements specified herein.

2.2 MATERIALS

- A. Portland Cement Plaster: ASTM C 150, Type I or III Common cement only.
- B. Gypsum Basecoat Plaster: ASTM C 28. Neat plaster for hand application of scratch coat over metal lath, concrete, and clay tile shall contain not less than 0.01 percent by weight of synthetic or vegetable fibers or not less than 0.02 percent by weight of mineral fibers.
- C. Plaster Bonding Agent: "Plaster-weld" or equal product with equivalent resin solids percentage.
- D. Bond Basecoat Plaster: A plaster having special bonding properties shall be used for application to concrete surfaces that have been sufficiently roughened to provide a mechanical key. The Bond Plaster shall be a type recommended by the Manufacturer. It shall be mixed and applied in strict accordance with the Manufacturer's directions.
- E. Molding Plaster: ASTM C 59.
- F. Special Finishing Hydrated Lime: ASTM C-206 Type S. Lime putty shall be made from special finishing hydrated lime, mixed with water to form a putty and allowed to stand for at least 15 minutes before using. Approved measures shall be taken to protect the putty from sun and to prevent excessive evaporation when stored.
- G. Finish Coat: Gauging plaster complying with ASTM C-28 or Keenes Cement Gypsum Plaster complying with ASTM C-61.
- H. Fiber: Non-staining synthetic or mineral product not more than 2" long, clean and free from foreign material.
- I. Sand: ASTM C35. Graduation of natural or manufactured sand for plaster shall be as follows:

<u>U.S. Standard Sieve Size No.</u>	<u>Percentage</u>	<u>Retained</u>
	<u>Max.</u>	<u>Min.</u>
4	0	0
8	5	0

16	30	5
30	65	30
50	95	65
100	100	90
200	100	95

- J. Water: Clean, fresh, potable, and free from injurious amounts of oils, acids, alkalis and organic matter injurious to the plaster.
- K. Acrylic Latex Admixture: Shall be a non-reemulsifiable resinous emulsion Larsen Products Corporation Acrylic Admix 101, or equal.
- L. Metal Lath: Complying with Fed. Spec. QQ-L-101a; cut from galvanized sheet steel, flat, expanded metal diamond mesh lath, not lighter than 3.4 lbs. per sq. yd. Where required over solid back-up or on stud walls where lath overlaps adjacent solid back-up, lath shall be self-furring type. Provide paper backing at intersection of stud wall and masonry wall.
- M. Metal Accessories: Grounds, beads, casing and corner beads shall be zinc-coated sheet steel, 26 ga. or heavier, with expanded or perforated flanges or clips so shaped and fabricated as to permit complete embedment in the plaster. Nails, metal beads, and other accessories shall be galvanized steel.
- N. Wire:
 - 1. Tie Wire: Steel, not less than 0.035" diameter, galvanized and annealed.
 - 2. Hanger Wire: Eight-gauge wire, galvanized and annealed.

2.3 MIXING OF PLASTER

- A. Gypsum Plaster:
 - 1. Mix and apply plaster in accordance with manufacturer's printed directions and the applicable ASTM specifications.
 - 2. Scratch and Brown Coats: Shall be mixed in the proportions of 100 lbs. Gypsum neat plaster to 2-1/2 cu. ft. of sand. Scratch and brown coats of fibered gypsum plaster shall be mixed in the proportions of 100 lbs. fibered gypsum plaster to one cu. ft. of sand.
 - 3. Finish Coats: Gypsum gauging plaster finish. Mix in the proportion of one part calcined gypsum to 4 parts lime by volume.
- B. Mix basecoat plasters by hand or in a mechanical mixer to a uniform consistency using sand aggregate except where a specific fire rating requires neat wood fiber gypsum or perlite aggregate plaster.

PART 3 - EXECUTION

3.1 GENERAL

- A. Sequence plaster installation properly with the installation and protection of other work, so that neither will be damaged by installation of other's work.
- B. Cut out and replace all unbonded spots. Where abutting other built-in materials, plaster shall be finished tightly against them and neatly trimmed unless otherwise indicated.
- C. Plaster thickness indicated shall be considered as a minimum; plaster shall be of such thickness required to plumb and square wall surfaces so that plaster is flush with adjacent surfaces.

- D. Replicate, repair and restore flat wall plaster as indicated. Replicate, repair and restore existing decorative moldings, applied panels, grooving and cast decoration as indicated.
- E. Plaster molding to be replicated shall be shaped in place from specifically prepared tools, cut to profile from existing moldings. Strip and clean existing moldings to produce clean, sharp profiles.
- F. Cast decorative elements from molds prepared from existing decorations, Strip and clean existing decoration to produce clean sharp profiles.
- G. Plaster repairs shall be executed edge to edge in long strips or large areas for each separate coat.
- H. Bring finished surfaces of plaster to true planes, and when complete surface shall be clean, free from blisters, pits, discoloration, cracks or other defects. In all cases the plastering throughout is to be delivered clean and perfect in every respect.

3.2 PREPARATION

- A. Inspect all surfaces to be plastered before beginning Work and correct all defects which will affect the proper execution of the Work.
- B. Carefully remove all soft, broken, loose or flaking, unbonded or unsound plaster back to substrate and to solid adjacent plastering, making clean sharp edges; cut back the existing plaster at an angle so that the patching will key properly and blend in with the existing surfaces at both sides of the crack.
- C. Where new lath is installed, partially remove existing metal lath, leaving enough lath exposed to tie to new lath.
- D. Install a minimum of 4 in. x 8 in. piece of metal lath diagonally at corners of openings larger than 2 sq. ft.
- E. Sweep masonry and lath clean. Key in clay tile and metal lath substrates shall be cleaned of all existing plaster.
- F. Concrete substrates shall be roughened to receive scratch or brown coats.
- G. Bonding agent shall be applied to all plaster, masonry and concrete surfaces for all plaster repairs. Application shall be in strict accordance with manufacturer's written recommendations and first and brown coats shall be applied directly over bonding agent.
- I. All preparation shall be done with compatible materials and methods that will not compromise the integrity of the plasters, will not telegraph through finished surfaces, and that are acceptable to the University's Representative.

3.3 PLASTER TREATMENTS

- A. Cracks under 1/16 inch Wide: Shall be filled with drywall compound or spackling and sanded, matching adjacent texture.
- B. Cracks 1/16 inch Wide or Wider and Other Plaster Damage: Dig out damaged areas as described under Article 3.2, "Preparation". Repair damaged area with 800 psi gypsum and sand patching plaster. Where cracking occurs at juncture between dissimilar substrates, cut back existing plaster and bridge substrates with paper-backed expanded metal lath, lapped 4" over each substance.
- C. Infill Walls: At infill metal stud walls, lap expanded metal lath 4" over existing adjacent hollow clay tile or concrete at joint between new wall and old. Provide paper backing to span joint, 4" to each side.

3.4 GYPSUM PLASTER ON METAL LATH AND CONCRETE

- A. For Metal Lath: Apply in 3 coats: scratch coat, brown coat, and finish coat.
- B. For Concrete Substrate: Repair with liquid bonding agent, bond basecoat plaster and finish coat plaster in strict accordance with the manufacturer's recommendations.
- C. Scratch Coats: Apply with sufficient material and pressure to form full bond with solid base materials. Cross-scratch the surface to form a bond for the brown coat.
- D. Brown Coats: Apply brown coat after scratch coat has hardened, not less than 24 hours after application of the scratch coat. All joints in brown coat plaster shall be lap joints. After drying, all shrinkage cracks shall be cut out and filled with scratch coat plaster.
- E. Finish Coat: Apply bonding agent to existing base coat and then apply finish coat over base coat of gypsum plaster. The finish shall be allowed to dry a few minutes and then shall be well-troweled with water to a smooth finish, free from blemishes. At Contractor's option Keenes cement may be used in lieu of standard gauging plaster.
- F. Plaster Thickness: The thickness of finish coat shall be from 1/16" to 1/8" and total thickness of gypsum plaster shall match existing, but no less than 5/8" on masonry and 3/4" on metal lath.

3.5 FINISHING

- A. Cut, patch, point-up and repair plaster as necessary to restore shrinkage cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to the substrate has failed.
- B. Sand smooth-troweled finishes lighting to remove trowel marks and arises.
- C. Remove temporary protection and enclosure of other work. Remove plaster form other surfaces which are not be plastered. Repair floors, wall and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris and stains.
- D. Provide final protection and maintain conditions which ensures plaster work being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 09250

GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all gypsum wallboard as shown on the Drawings and as specified, complete.

1.2 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Comply with fire-resistance ratings as follows:
 - 1. Fire-Resistance Ratings: As indicated by GA File Number in GA-600 "Fire Resistance Design Manual" or design designated in UL "Fire Resistance Directory " or in the listing of another testing and inspecting agency acceptable to the City of L. A.

1.3 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Temperature and Humidity Conditions. Do not install joint treatment compounds unless the areas of installation comply with the minimum temperature and ventilation requirements recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fire-rated gypsum wallboard shall conform to ASTM C 36 and ASTM E 119, 5/8-inch (16 mm) thick, unless otherwise indicated, by 48 inches (1.2 m) wide by a length sufficient to eliminate end joints up to 12 feet (3.5 m) long maximum. Long edges shall be tapered. Deliver wallboard to job bundled with end tapes bearing UL label or stamped on the back, with the correct UL "design number" corresponding to the Drawings and specifications.
- B. Non-load bearing metal stud system shall conform to ANSI A42-1 and A42-4 of sizes shown on the Drawings. Fabricate studs from 20-gauge galvanized steel unless otherwise specified. Stud system shall be complete with top and bottom runners and all necessary fastenings and accessories as indicated in the partition manufacturer's printed directions.
 - 1. The minimum stud gauge and sizes shall be in accordance with the manufacturer's technical data load and limiting height tables.
- C. Fasteners for gypsum wallboard to metal supporting members shall be of the screw-type recommended in the manufacturer's printed directions.
- D. Channels shall be fabricated of cold rolled steel, galvanized or protected with rust inhibitive paint.
- E. Joint Reinforcing Tape: Use joint reinforcing tape, regular or metal-backed, of the same manufacturer as the gypsum wallboard or recommended by the manufacturer of the gypsum wallboard.

- F. Joint Cement: Use prefinishing bedding cement and finishing cement of the same manufacturer as the reinforcing tape.
- G. Water shall be potable.
- H. Metal corner beads shall be electro-galvanized steel with 1-inch (25 mm) flange for 1/2-inch (13 mm) board and 1-1/4-inch (32 mm) flange for 5/8-inch (16 mm) board.
- I. Metal trip and casings shall be electro-galvanized steel produced specifically for use with drywall construction.
- J. Miscellaneous fittings, clips, attachments, control joints, etc. shall be of the same quality and design for compatibility with the above-specified items.
- K. Sound-Rated Gypsum Drywall Partitions: Thickness and sound transmission class rating shall be as indicated on the Drawings and in accordance with ASTM E 90 and ASTM E 413.
 - 1. Gypsum wallboard and metal stud system shall be as herein specified.
 - 2. Caulking at runner tracks and all cut-outs shall be acoustical type as specified in Section 07900, SEALANTS.
 - 3. Sound insulation shall be fiber insulation blanket as specified in Section 07200, BUILDING INSULATION.

2.2 ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

- 1. Current requirement refers to the date on which the materials are installed in the building.
- 2. Interior refers to all building construction that is inside of the exterior weatherproofing material.
- 3. Refer to <http://www.aqmd.gov/rules> for the actual current version of SCAQMD Rule #1168 that will be applicable at the date of installation during construction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of Partitions.
 - 1. Metal stud partitions shall be of the type and size shown on the Drawings and as herein specified. Accurately align partitions according to the partition layout.
 - a. Runner Tracks. Securely attach as follows.
 - 1) To concrete slabs, using concrete stud nails or shielded screws, spaced not to exceed 24 inches (600 mm) O.C., and 2 inches (50 mm) from each end.

- 2) At sound rated partitions set runner tracks in continuous bead of caulking. Refer to Section 07900 SEALANTS.
- b. Studs. Studs shall be of sufficient length to securely engage the floor and ceiling runner track. Place studs vertically, engaging runner tracks by rotating for friction fit. Secure studs adjacent to door and window frames, at partition intersections and at corners to regular runner tracks at floor and ceiling with metal screw fasteners as recommended by stud manufacturer.
- c. Space studs not to exceed 16 inches (400 mm) O.C. and place a stud 2 inches (50 mm) from abutting partitions, internal corners and partition terminals.
- d. Use double studs anchored as herein specified immediately adjacent to door frames and at each side of control joints. Gauges and types of jamb studs shall comply with stud manufacturer's printed recommendations for the types of frames and weights of doors used in the project with minimum of 20-gauge. Insert studs into steel door frames, nest in notches of the jamb anchor clips (4 per side) and securely attach using 2 self-tapping screws or bolts at each of the jamb anchors. Fabricate sill and header sections from metal runner tracks and install over less-than-ceiling height door frames and above and below borrow light frames. Anchor to studs in accordance with manufacturer's printed directions. Use an aligning 3/4-inch (20 mm) channel over each door head, extending out on each side of the frame to the third stud. Securely wire tie the channel to each stud. Grout full the back of metal door bucks. Install metal studs which are components of fire-rated partitions in accordance with the requirements of applicable UL "Fire Resistance Index" design numbers.
2. Corner Beads. Set beads securely at all external corners in single lengths.
3. Metal trim and casings shall be used where called for, where wallboard drywall ceilings or walls abut masonry and elsewhere as required to stop finished surfaces against a dissimilar material to form a neat and definite joint. Use casing bead with attached vinyl gasket where wallboard abuts metal in an exterior wall. Metal trim or casings shall be of dimension to fit material trimmed.
- B. Sound Insulation. Where indicated on the Drawings, install sound insulation materials in accordance with the manufacturer's printed recommendations.
- C. Installation of Gypsum Wallboard.
 1. Cutting Wallboard. Cut gypsum wallboard by scoring and breaking, or by sawing, working from the face side. Where board meets projecting surfaces, it shall be scribed neatly.
 2. Placing Wallboard.
 - a. Apply gypsum wallboard first to ceiling, then to walls.
 - b. Apply boards to framing members as indicated in the manufacturer's printed recommendations. Board shall be of maximum practical length to minimize number of end joints occurring. Bring board into contact with adjacent board but do not force it into place.

- c. At sound-rated partitions, set perimeter of boards in caulking bead. Refer to Section 07900, SEALANTS.
 - d. Make joint layout at openings so that no end joint will align with edges of opening.
- 3. Fastening.
 - a. Space fasteners not less than 3/8-inch (10 min) from edges and ends of wallboard.
 - b. Where wallboard is to receive ceramic tile over 1/4-inch (6.4 mm) thick, board shall be fastened at 4-inch (100 mm) O.C.
 - c. Fastening of gypsum wallboard to metal supporting members shall be with screw-type fasteners. For vertical application of wallboard, screw fasteners shall be spaced a maximum of 12 inches (300 mm) O.C. in the field of the base and 8 inches (200 mm) O.C. staggered along the vertical abutting edges. For horizontal application, screw fasteners shall be spaced a maximum of 12 inches (300 mm) O.C. along the abutting end joints. Screws shall be power-driven with an electric screwdriver and set so that the screw head provides a slight depression below the surface of the board without tearing through the face paper.
- 4. Joint Treatment.
 - a. Apply field joints and corners in accordance with the wallboard manufacturer's printed recommendations. Joints shall receive tape and a minimum of three (3) coats of cement. Mix cement in accordance with manufacturer's printed recommendations and allow to dry thoroughly between coats, a minimum of 24 hours. Finish coat shall be finished smooth to a plane surface. Protect external corners with metal corner beads. Treat fastener dimples as outlined above for joints, but without tape.
 - b. Where board is used as 1-hour fire-rated back-up material, the taping and cementing of joints and fasteners shall be in accordance with the applicable UL requirements.
- 5. Control joints shall be provided in wallboard surfaces and partition runs at a spacing not to exceed 30 feet (9.0 m) O.C. Provide control joints from both corners of all door frames to the ceiling.

END OF SECTION

SECTION 09511

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.2 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale utilizing latest version of AutoCAD and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/8 inch = 1 foot
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of full-size samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- G. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.

- H. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to University's Representative.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 450 or less.
- E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 2. CISC's Guidelines for Systems Requiring Seismic Restraint: Comply with CISC's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 3. CBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will

be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard anti-microbial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.2 MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Products:
 - 1. ACT #1: Armstrong World Industries, Inc. Cortega item 747 or equal. Panel Size: 24" x 48" x 5/8".
- B. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type IV, Fiberglass with DuraBrite acoustically transparent membrane; or equal., Form 2, Pattern E
- C. Color: White
- D. LR: Not less than 0.82
- E. NRC: Not less than 0.55
- F. CAC: Not less than 40.
- G. Edge Detail: Square Lay-In.
- H. Thickness: 5/8 inch.
- I. Size: 24 by 48 inches.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Post installed expansion anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Products:
1. Armstrong World Industries, Inc. 15/16" Exposed Tee System "Prelude ML"
- B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/653M, not less than G30 coating designation, with pre-finished 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flanges formed with a smooth face
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white
 6. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers:
1. Armstrong World Industries, Inc.
 2. Chicago Metallic Corporation.
 3. Or equal.
- B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

2.6 ENVIRONMENTAL REQUIREMENTS – ADHESIVES & SEALANTS

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:

- a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- c. Or equal.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non sag, paintable, non staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

1. Current requirement refers to the date on which the materials are installed in the building.
2. Interior refers to all building construction that is inside of the exterior weatherproofing material.
3. Refer to <http://www.aqmd.gov/rules> for the actual current version of SCAQMD Rule #1168 that will be applicable at the date of installation during construction.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and CISCAs "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 2. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

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

END OF SECTION

SECTION 09658

RUBBER BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Topset coved rubber base for installation with hard surface flooring.

B. Related Sections:

1. Section 09677: Static Dissipative Resilient Tile Flooring

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's published technical data describing materials, construction and recommended installation directions. Submit technical data and installation instructions for each adhesive material.
- B. Maintenance Instructions: Submit manufacturer's recommendations for maintenance, care and cleaning of base.
- C. Samples: Submit Samples of cove and straight top set base in each available color. Following color selections, submit Samples, not less than 12 inches long of each selected color and type. Submit pint cans of each type adhesive.
- D. Maintenance Materials: Before Substantial Completion, deliver at least 50 lineal feet with 5 end stop units and 5 outside corner units of each color of rubber base installed. Deliver the materials in unopened factory containers or in sealed cartons with labels identifying the contents, matching installed materials. Include unopened cans of adhesives adequate to install the maintenance materials.
- E. Submit proof of installer qualifications specified in Paragraph 1.3 A Below.

1.3 QUALITY ASSURANCE

- A. Qualifications of Installer: Minimum 5 years experience in successfully installing the same or similar flooring materials.
- B. Comply with the following as a minimum requirement:
1. ASTM E 84: Surface Burning Characteristics of Building Materials.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered to the Project site in original unopened manufacturer's packaging clearly labeled with manufacturer's name. Materials shall be stored at not less than 70 degrees F for not less than 48 hours before installation.

1.5 PROJECT CONDITIONS

- A. Ventilation and Temperature: Verify areas that are to receive rubber base are ventilated to remove fumes from installation materials, and areas are within temperature range recommended by the various material manufactures for site installation conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Burke/Mercer Flooring Products, 2250 S. Tenth Street, San Jose, CA 95112.
- B. R.C. Musson Rubber Co., 1320 Archwood Avenue, Akron OH.
- C. Flexco Company, P.O. Box 553, Tuscumbia, AL 35674.
- D. Or equal.

2.2 MATERIALS

- A. Rubber base: Conform to ASTM F 1861; Group I, solid (homogeneous); Type TS, thermoset vulcanized rubber; Style A, straight; and Style B; 4 inch high unless otherwise indicated, integral colors as selected, non-shrinking, 1/8 inch thick, with matching molded inside corners and end stops.
- B. Base Adhesive: Water based, low odor type formulated specially for use with rubber base, and manufactured or recommended by manufacturer of rubber base.
- C. Use adhesives that comply with most current levels specified by the South Coast Air Quality Management District (SCAQMD) Rule # 1168.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate the Work of this section with other sections to provide a level, smooth and clean finish surfaces to receive rubber base.

3.2 EXAMINATION

- A. Field verify dimensions and other conditions affecting the Work of this section before commencing the Work of this section.
- B. Before Work is started, examine surfaces that are to receive rubber base. Deficiencies shall be corrected before starting the Work of this section.

3.3 PREPARATION

- A. Do not start preparation until adjacent concrete floor slabs are at least 90 days old and finish flooring is installed.
- B. Install rubber base when ambient temperature is 70 degrees F or higher.

3.4 INSTALLATION

- A. Install cove base at all hard floors, including resilient flooring, concrete. Install straight base at carpet and other soft floors, unless otherwise required.
- B. Securely fasten cement base to backing in long lengths in accordance with manufacturer's recommendations. Lay out lengths so that not less than 18 inches long filler pieces are provided. Assure that top and toe continuously contact the wall and floor, and that all joints are tight. Install factory formed internal and external corners, and end stops where cove base ends at jambs and offsets.
- C. Base and outside corners shall be rolled with a seam roller before adhesive sets.

3.5 CLEANING

- A. Maintain surfaces of base clean as installation progresses. Clean rubber base when sufficiently seated and remove foreign substances.
- B. Clean adjacent surfaces of adhesive or other defacement. Replace damaged and/or defective Work to the specified condition.

3.6 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.7 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 09677

STATIC DISSIPATIVE RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide static dissipative flooring and accessories as shown on the drawings and specified, complete.

1.2 RELATED SECTIONS

- A. Other Division 9 sections for floor finishes related to this section but not the work of this section.
- B. Division 16 Electrical; not the work of this section.

1.3 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Select an installer who is competent in the installation of static dissipative resilient tile flooring with a minimum experience of five years installing such floors.
- B. Provide static dissipative resilient tile, adhesive, copper grounding strips, and maintenance finish supplied by one manufacturer
- C. If required, provide accessories including leveling and patching compounds supplied by one manufacturer.
- D. Provide products with the following fire-test response characteristics as determined by testing identical products per the test method indicated below by a testing and inspecting agency acceptable to the University's Representative.
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.
- E. Provide flooring material to meet the following electrical properties when installed according to manufacturer's instructions with the required adhesive:
 - 1. ASTM F 150 (Electrical Resistance) between 106 and 109 ohms.
 - 2. Federal Test Method 4046-10IC (Static Decay) 5000 volts to zero in less than 0.2 second.
 - 3. AATCC-134 (Static Generation) less than 100 volts with conductive footwear at 20% relative humidity.

1.4 SUBMITTALS

- A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

- C. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- D. Submit proof of installer's qualifications specified in Paragraph 1.3 A above.

1.5 ENVIRONMENTAL CONDITIONS

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 100°F (38°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
- D. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 PRODUCTS

2.1 RESILIENT TILE FLOORING MATERIALS

- A. Provide Static Dissipative Tile having a nominal total thickness of 1/8 in. (3.2 mm), 12 in. x 12 in. (305 mm x 305 mm), composed of polyvinyl chloride resin binder, fillers, pigments, and antistatic additive with colors and texture dispersed uniformly throughout its thickness. Vinyl composition tile shall meet size, thickness, indentation, impact, dimensional stability, resistance to chemicals, and squareness requirements of ASTM F 1066, Class 2 — through pattern.

2.2 WALL BASE MATERIALS

- A. Provide 1/8 in. thick, 4 in. high Color-Integrated Wall Base with a matte finish, conforming to ASTM F 1861, Rubber Cove.

2.3 ADHESIVES

- A. Furnish Armstrong S-202 Static Dissipative Tile Adhesive or equal with 2 in. (5.08 cm) wide x 24 in. (60.96 cm) long copper ground-connection strips under the tile. Furnish Armstrong S-725 Wall Base Adhesive or equal at the wall base as recommended by the manufacturer of the material to which it is to be applied. Adhesive shall also comply as stated below in B.
- B. Use adhesives that comply with the most current levels specified by the South Coast Air Quality Management District (SCAQMD) Rule # 1168.

2.4 ACCESSORIES

- A. Provide Armstrong S-392 Static Dissipative Tile Polish for application as initial maintenance finish or equal as recommended by the manufacturer of the material to which it is to be applied.
- B. For patching, smoothing, and leveling monolithic concrete, provide underlayment as recommended by the flooring manufacturer.
- C. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- D. Provide transition/reducing strips tapered to meet abutting materials.
- E. Provide threshold of thickness and width as shown on the drawings.
- F. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or builnose edge, with color to match or contrast with the flooring, or as selected by the University's Representative from standard colors available.
- G. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections shall be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with underlayment as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not

compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.

- C. Perform subfloor Calcium Chloride Tests (and Bond Tests) as described in Manufacturer's installation manual to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring.
- D. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.3 INSTALLATION OF TILE FLOORING

- A. Install flooring in strict accordance with the latest edition of Manufacturer's installation manual.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- F. Install copper grounding strips into adhesive in strict accordance with manufacturer's written instructions.
- G. Roll tile with a 100-pound roller. Refer to specific rolling instructions of the tile manufacturer.

3.4 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

3.5 CLEANING AND PROTECTION

- A. Perform initial maintenance according to the latest edition of manufacturer's installation manual.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, work specified in other sections, or the placement of fixtures and furnishings.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. The term "paint," as used herein, means the entire coating system, including emulsions, enamels, paints, stains, varnish, sealers, cement-emulsion fillers, and other coatings, whether used as prime, intermediate, or finish coats.
2. Provide painting of all surfaces exposed to view, except as otherwise specified. Provide preparation of surfaces to be painted and "back priming" of trim and millwork.
 - a. Top, bottom and edges of doors shall be finished as specified for the faces of the doors after they have been fitted.
 - b. Prime coats specified herein will not be required on items delivered with prime or shop coats.
 - c. Work in Existing Building.
 - 1) Where new construction has been performed or installed at connections to existing buildings, areas shall be finished to give a uniform appearance.
 - 2) All new construction work shall be finished as specified for that type of surface.

1.2 SUBMITTALS

A. Qualifications: Submit the following information to University's Representative for approval. Submittal shall be made as required for shop drawings.

1. Name of manufacturer whose products are proposed for the Project. Provide only one manufacturer's materials throughout the job except for special finishes as specified and specialty items, including shellac, oils, waxes, polishes and cleaners.
2. Manufacturer's complete and detailed specifications for the materials and methods to be employed for each type of application or finish herein specified.

B. Samples:

1. Prepare samples in accordance with the requirements listed. No painting shall begin until samples are approved by University's Representative.

2. When the building is ready for painting, University's Representative will designate an area to be finished according to the Specifications. Furnish materials and application according to the specifications. The designated area, when accepted, together with samples submitted and reviewed, shall serve as a standard for the remainder of the work as to material quality, appearance, color matching, and workmanship. Commence no other interior painting and finishing until the pilot area has been approved by University's Representative.
- C. Maintenance Materials: Deliver to University, to a location to be verified, 1 gallon (4 liters) of paint of each color used on this project with applicable printed instructions.
- D. Shop Drawings and Product Data: The following list includes the required shop drawings that shall be submitted.
 1. Paint specifications.

1.3 PRODUCT DELIVERY AND STORAGE

- A. Delivery of Materials: All paint shall be delivered to the Project site in the manufacturer's sealed containers with manufacturer's labels intact. Labels shall bear the manufacturer's name, brand, type of paint, color of paint and instructions for use.
- B. Storage of Materials, Equipment and Fixtures:
 1. Storage and Protection. Store all paint and other related materials used on the job in a single place. Keep such storage place clean and orderly. Oily or solvent soaked rags and all waste shall be placed in covered containers and shall be removed at the end of each day's work, and all necessary precautions shall be taken to reduce fire hazard to a minimum. Upon completion of the work, the storage space shall be left clean and in good condition.

1.4 JOB CONDITIONS

- A. Protection of Work: Protect painting work and cover and protect work and property of others from damage. Prevent paint materials from being spilled or spattered onto surfaces which are not to be painted. During painting of exterior work, cover windows, doors, concrete, and other surfaces not to receive the coating being applied.
- B. Ventilation: Ensure that ventilation in each room or areas where painting is performed is adequate to prevent concentration of paint fumes and odors, and furnish temporary supplementary ventilation as required and necessary.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Paint System: Use paint products of one manufacturer unless otherwise specified or approved. In any case, primers, intermediate and finish coats in each paint system shall be products of same manufacturer, including thinners and coloring agents, except materials furnished with prime coat. Provide paints from one of the following manufacturers.
 1. Frazee
 2. Dunn-Edwards

3. Or Equal.
- B. Factory Mixing: To maximum extent practicable, factory mix each paint material to color, gloss, and consistency for application.
- C. Use only water-based materials.
- D. ENVIRONMENTAL REQUIREMENTS

Interior paints and coating applied on-site and used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall meet the limitations and restrictions concerning chemical components set by the following standards:

1. Architectural paints, coatings and primers applied to interior walls and ceilings. Do not exceed the VOC content limits established in the most current Green Seal Standard GS-11.
2. Anti-Corrosive and Anti-Rust Paints: Do not exceed the VOC content limit established in the most recent Green Seal Standards GC-03, Anti-Corrosive Paints.
3. Clear wood finishes, floor coatings, stains, varnishes and shellacs applied to interior elements: Do not exceed the VOC content limits established in most current South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Preparation of Surfaces:
 1. Give written notification to University's Representative seven (7) days in advance, in regard to painting schedule, to coordinate the required inspections.
 2. Cleaning of Surfaces. All surfaces to be finished shall be clean and free of dirt, wax, dust, grease, oil and other surface contaminants.
 3. Wood. Sandpaper to a smooth and even surface and wipe with tack rag before first coat and between coats.
 - a. Touch up sap spots and knots with a sealer recommended by the paint manufacturer. Fill voids and nail holes after primer or first coat is dry, using a filling compatible with the finishing system specified and tinted to camouflage repairs.
 4. Iron and Steel. Remove all loose scale and rust from iron and steel to produce a satisfactory surface for painting.
 - a. Wash all metal surfaces with metal prep to remove any dirt or grease before painting.
 - b. Touch up chipped or abraded spots on items that have been shop coated with a primer before proceeding.
 5. Aluminum. All aluminum to be painted shall be wiped clean with phosphoric acid cleaning compound.

6. Concrete
 - a. Prepare surfaces to be painted by removing all dirt, dust, oil, grease and surplus concrete.
 - b. Spot-coat filled areas, suction spots and any other defects with one coat of wall primer and sealer.
7. Plaster and Drywall Surfaces.
 - a. Fill all cracks, gouges, holes and abrasions with a plaster patching compound or "spackle."
 - b. No paint or sealer shall be applied on plaster until it is dry.

3.2 INSTALLATION/APPLICATION

- A. Installation: All materials shall be evenly spread and smoothly flowed on without runs or sags.
 1. No painting shall be done in rooms or areas where plaster or concrete is to be applied or cured, until such materials are dry as determined with a moisture meter.
 2. Adhere to all manufacturer's printed recommendations with respect to temperature and surface conditions set forth for a particular product. Nothing in these Specifications shall be deemed to reduce the requirements of these recommendations.
 3. Do not thin, adulterate, or otherwise change material except as recommended by the manufacturer.
 4. All coats shall be dry before applying succeeding coats.
 5. The material for stipple finish shall be of correct consistency to produce a moderate textured stipple.
 6. Barricades. Maintain barricades and wet paint signs for duration of need.
 7. Scaffolds. Provide and transfer scaffolds, staging and planking necessary for performance of the work.

3.3 ADJUSTMENT AND CLEANING

- A. Cleaning and Protection:
 1. Protect all work by a covering or other method as approved during the progress of work. Any damage resulting from inadequate protection shall be repaired as approved and at Contractor's expense.
 2. Upon completion of the work, remove all paint and varnish spots from the floors, glass, and other surfaces. Use only products recommended by manufacturer for removal of spots and spills.

3.4 SCHEDULES

- A. Painting Schedule:

1. Number of Coats. The number of coats of finishes specified hereafter are the minimum which shall be used for the various surfaces. Apply materials with an absolutely uniform film thickness, with opaque finishes providing such complete hiding that an additional coat would not improve the hiding.
2. In general, the type of paint specified herein is referred to by general terms, without reference to any paint manufacturer. The paint to be used shall be the best grade of the paint manufacturer, conforming to the terminology used herein and specified for the type of surface to which the paint is to be applied.
3. Interior "Keene's" Cement Plaster Walls.
 - a. One Coat: Water-based primer.
 - b. Two Coats: Water-based enamel.
4. Interior Concrete, Cement Plaster and "Keene's" Cement Plaster Ceilings.
 - a. One Coat: Water-based primer.
 - b. Two Coats: Water-based enamel.
5. Interior Plaster Surfaces.
 - a. One Coat: Water-based primer, tinted.
 - b. Two Coats: Water-based enamel.
6. Interior Gypsum Wallboard.
 - a. One Coat: Water-based primer, tinted.
 - b. Two Coats: Water-based enamel.
7. All Interior Hardwood, Stain Finish unless otherwise shown on the Drawings.
 - a. One Coat: Paste filler.
 - b. One Coat: Water-based stain.
 - c. Two Coats: Water-based varnish (gloss).
 - d. One Coat: Water-based varnish (satin, unless otherwise specified).
 - e. Sand lightly between coats.
8. All Interior Woodwork where indicated on Drawings to have painted finish, or indicated as paint-grade wood.
 - a. One Coat: Interior water-based enamel primer or undercoat, tinted.
 - b. One Coat: Interior water-based enamel.
9. Interior Exposed Ferrous Surfaces unless otherwise specified.
 - a. One Coat: Rust-inhibiting water-based metal primer.

- b. Two Coats: Water-based enamel.
- 10. Interior Galvanized Surfaces unless otherwise specified.
 - a. One Coat: Zinc dust-type primer for galvanized metal.
 - b. Two Coats: Water-based enamel.
- 11. Ductwork Exposed to View Through Registers and Grilles.
 - a. One Coat: Water-based enamel.
- 12. The following surfaces will not require painting.
 - a. Work having complete factory finish other than prime coat.
 - b. Finish hardware, except prime-coated items.
 - c. Resilient base.
 - d. Concrete floors, except as otherwise indicated.
 - e. Galvanized ductwork, except where exposed.
 - f. Code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
 - g. Surfaces indicated on the Drawings "not to be painted."

3.5 CLEANING AND TOUCH-UP WORK

- A. Make detailed examination of paint finishes after painting work is completed. Remove splatterings of paint material from adjoining work, including from plumbing fixtures, trim, tile, and finish metal surfaces, and make good any damage thereto that may be caused by such cleaning operations as approved and at Contractor's expense. Touch-up any abraded, stained, or otherwise disfigured painting work, as approved, and leave entire painting work in first-class condition.

3.6 STANDARD SAFETY COLOR CODE

- A. Where conflicts occur between the color markings identified herein and markings required under NFPA 99, the requirements of NFPA 99 shall take precedence.
- B. Markings designated by type of room area.
 - 1. Machinery rooms, fan rooms, tunnels, and equipment rooms.
 - a. All exposed pipe lines, ducts, plenums and conduits shall not be painted but all hangers or supports shall be painted per Applicable Code Requirements.
 - b. All machinery and equipment, insulated or otherwise, shall receive one prime coat and two coats of colored industrial enamel finish. Prime coat. by Contractor may be omitted on Factory painted equipment if approved by University's Representative.
 - 2. All other areas:

- a. All exposed pipe lines, ducts, plenums, conduits, hangers, etc., in finished areas shall be painted with one prime coat and two coats of industrial enamel to match adjacent areas and pipes shall be identified at entrance and exit of all pipes within such areas.
 - b. All concealed pipe lines which are accessible by access doors, ceiling removal, etc., shall be identified at each point of entry, junction, or exit to the concealed space and identification shall be repeated at distances not to exceed 20 feet between identifying markers, and shall be repeated at each valve. Exception to the preceding: All condenser water (tower) lines shall receive 2 coats of prime their entire length, if pipe material is copper or galvanized steel.
 - c. All concealed pipe lines, conduits, etc., which are furred in or otherwise non-accessible shall not be painted but all hangers or supports shall be painted according to Applicable Code Requirements. Exception to the preceding: All condenser water (tower) lines shall receive 2 coats of prime their entire length if pipe material is black steel. Painting is not required if pipe material is copper or galvanized steel.
 - d. All machinery and equipment shall be painted in accordance with Paragraph 3.6 B. I.b. above.
- C. Procedure for Painting Copper Pipe: Thoroughly clean with steel wool and de-grease with solvent. Apply one coat of spar varnish and allow to dry for 48 hours. Apply enamel paint per schedule.
- D. General Painting Procedure: Each step shall be approved and accepted before proceeding with the next step.
- 1. Cleaning and preparing surfaces for painting:
 - a. Clean all surfaces free from dirt, oil, wax, grease, etc., before applying paint.
 - b. After cleaning the surface, all galvanized steel shall be prepared for paint by treating with 661 F774 White Metal Primer, QD 43-7 Galv-Alum, or equal, before applying the prime coat.
 - 2. Prime coat for metal surfaces: See paragraph 3.4 above.
 - 3. Finish Coats: See paragraph 3.4 above.

NOTE: The following requirement applies to Division 15 of the Specifications: All exposed insulation and cloth covering in finished areas shall receive two (2) coats of water-based enamel paint. Follow insulation manufacturer painting instructions.

END OF SECTION

SECTION 10400

SIGNAGE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and Samples.
 - 1. Submit full-size rubbings for metal plaques.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the University's Representative, and marked for intended use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: Alloy recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher, with not less than the strength and durability of 5005-H15.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher, with not less than the strength and durability properties of 6063-T5.
- D. Bronze Castings: ASTM B 584, Alloy UNS C83600 (No. 1 manganese bronze).
- E. Bronze Plate: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal).
- F. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304.
- G. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- H. Plastic Laminate: High-pressure laminate engraving stock with face and core in contrasting colors.
- I. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 SIGNS

- A. Interior Panel Signs: Reverse silk-screened clear acrylic with opaque background with square-cut edges and square corners.
 - 1. Finishes and Colors: As selected from manufacturer's full range
 - 2. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

3. Provide signs for all rooms mounted on the wall beside the room door

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate signs where indicated or directed by the University's Representative. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
- B. Wall-Mounted Signs:
 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces, other than vinyl.
 2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
 3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
 4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 5. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes.
- C. Dimensional Characters: Mount characters with backs in contact with wall surface

END OF SECTION

SECTION 15052

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Plumbing demolition.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. All equipment

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Coupling and Nipples: Galvanized-steel coupling or nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to University.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Fill annular space with silicone caulking.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1/4-inch (6-mm) annular clear space between pipe and sleeve for installing caulking.
 1. Install steel pipe for sleeves 2.5 inches and larger in diameter.
 2. Install sheet metal sleeves for penetrations 2 inch and smaller in diameter.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 7 Section 07840 "Fire Stops and Smoke Seals" for materials.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Mechanically pulled joints are not permitted.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 15053

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. HVAC demolition.
3. Equipment installation requirements common to equipment sections.
4. Concrete bases.
5. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 QUALITY ASSURANCE

- A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 COORDINATION WITH STRUCTURAL WORK

- A. Placement of new structural steel beams at floors 1 and 6 must be completed within 4 days each, max, to include a weekend, (i.e. Friday, Saturday, Sunday and Monday) to avoid long term disruption to mechanical systems serving adjacent spaces. This includes only the removal of ductwork or piping in the way of new steel beams, the erection of new steel beams, (including inspection) welding of new steel beams (including inspection) and the put-back of removed infrastructure. This does not include removal or put-back of ceilings.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- C. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 2. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 3. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to University's Representative.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install escutcheons for penetrations of walls, ceilings, and floors.
- J. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- K. Verify final equipment locations for roughing-in.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to details on the drawings..
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 3. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION

SECTION 15061

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from University's Representative.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Hot and Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for all insulated piping.

2.4 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, strainers, NPS 2-1/2" (DN 65) and larger, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/2" to NPS 2" (DN 12 to DN 50): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size or installation limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS ½" to NPS 2" (DN 12 to DN 50).
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS ½" to NPS 2" (DN 12 to DN 50), requiring clamp flexibility and up to 2 inches (50 mm) of insulation.
 - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS ½" to NPS 2" (DN 12 to DN 50).
 - 4. U-Bolts (MSS Type 24): For support of pipes NPS ½" to NPS 2" (DN 12 to DN 50).
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 1/2" to NPS 2" (DN 12 to DN 50).

- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. C-Clamps (MSS Type 23): For structural shapes.
 - 6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 7. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 15062

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Refrigerant Pipe Hangers:

1. Strut Pipe Clamps: Unistrut Cush-a-Clamp Assembly for 1-5/8" Framing or equal.
2. Strut Framing: Unistrut P1000, 1-5/8", Galvanized, non-punched or equal.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized carbon steel. Minimum size: 3/8".

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- B. Equipment support in first paragraph below requires calculating and detailing at each use.
- C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- H. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1- inches.

END OF SECTION

SECTION 15088

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
 - 2. Condensate piping, indoors.
- B. Related Sections:
 - 1. Division 15 Section "Refrigerant Piping."

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to the University's Representative. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50-ppm when tested according to ASTM C 871.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.

- c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- d. Or equal.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - e. Or equal.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Aluminum Jacket: Comply with ASTM B 209 Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Products:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - d. Or equal.
 - 2. Sheet and roll stock ready for shop or field sizing.
 - 3. Finish and thickness are indicated in field-applied jacket schedules.

2.4 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 1. Products:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

- c. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

3.3 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.4 PIPING INSULATION SCHEDULE

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.5 INDOOR AND OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction-Gas Piping: Insulation shall be:
 - 1. Flexible Elastomeric: 1- inches thick.
- B. Condensate drain lines insulation shall be:
 - 1. 1/2-inches thick.

3.6 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. Embossed Aluminum Jacking

END OF SECTION

SECTION 15111

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze gate valves.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
 2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Gate Valves: With rising stem.
 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
1. Solder Joint: With sockets according to ASME B16.18.
 2. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Jamesbury; a subsidiary of Metso Automation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Or equal.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Or equal.

2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Or equal.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Or equal.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:

-
1. Shutoff Service: Ball or gate valves.
 - B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
 - C. Select valves, except wafer types, with the following end connections:
 1. For Copper Tubing, NPS 2" (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
- 3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE
- A. Pipe NPS 2" (DN 50) and Smaller:
 1. Ball Valves: Two piece, full port, brass or bronze with brass bronze trim.
 2. Bronze Gate Valves: Class 125, rising or non-rising stem.

END OF SECTION

SECTION 15140

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Above ground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Valves.
3. Escutcheons.
4. Sleeves and sleeve seals.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article herein for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, hard drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - a. Manufacturers: Provide products by one of the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Or equal.

- b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

- A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 VALVES

- A. Comply with requirements in Division 15 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Nipples:
 - 1. Description:
 - a. Pressure Rating: 150 psig (1035 kPa).
 - b. End Connections: NTP.

2.6 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with set screws.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

2.7 SLEEVES

- A. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install shutoff valve immediately upstream of each dielectric fitting.
- C. Install domestic water piping level and plumb.

- D. Install seismic restraints on piping. Comply with requirements in Section 15061 for seismic-restraint devices.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping adjacent to equipment and specialties to allow service and maintenance.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 15 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2" (DN 50) and smaller.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 15 Section "Domestic Water Piping".

- 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
- 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2" (DN 50) and smaller: Use dielectric nipples.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 15061 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/2" (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1" and NPS 1-1/4" (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 1-1/2" and NPS 2" (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
- D. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by California Plumbing Code (CPC) 2007, Table 6-5. Comply with requirements in Section 15052 for connection sizes.

3.7 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of exposed walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.

2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Equipment Rooms: One piece, cast brass with polished chrome-plated finish.

3.8 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Sealants" for joint sealants.
- H. Seal space outside of sleeves in concrete walls with grout or silicone caulking.
- I. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- J. Install sleeve materials according to the following applications:
 1. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes 2.5" and larger.
 - b. Galvanized-steel sheet sleeves for pipes smaller than NPS 2" (DN 50).
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 2. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 2" (DN 50).
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Comply with requirements in Division 7 Section 07840 "Fire Stops and Smoke Seals" for firestop materials and installations.

3.9 IDENTIFICATION

- A. Identify system components.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by University's Representative.
2. During installation, notify authorities having jurisdiction at least three days before inspection must be made. Perform tests specified below in presence of University's Representative.
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection by University's Representative to observe tests specified below and to ensure compliance with requirements.
3. Re-inspection: If University's Representative finds that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
4. Reports: Prepare inspection reports and have them signed by University's Representative.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

- b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to University's Representative. Repeat procedures if biological examination shows contamination.
 - B. Prepare and submit reports of purging and disinfecting activities.
 - C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- 3.12 PIPING SCHEDULE
- A. Above ground domestic water piping, NPS 2" (DN 50) and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and brazed soldered joints.
- 3.13 VALVE SCHEDULE
- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2" (DN 50) and smaller.

END OF SECTION

SECTION 15150

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:

- 1. Pipe, tube, and fittings.
- 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

- 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

- 1. Gaskets: ASTM C 564, rubber.

- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

- 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

- a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

- C. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

- 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Above ground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section 15052 "Common Work Results for Plumbing"
- B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.
- C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook,"
- D. Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent away from vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by University's Representative.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section 15052 "Common Work Results for Plumbing"
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section 15061 "Hangers and Supports for Plumbing Piping & Equipment". Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports for Plumbing and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2" and NPS 2" : 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 10 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by CPC Table 7-3. Refer to Division 15 Section 15140 "Domestic Water Piping"
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by University's Representative.

3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 FIELD QUALITY CONTROL

- A. During installation, notify University's Representative at least 24 hours before inspection must be made. Perform tests specified below in presence of University's Representative.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by University's Representative to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If University's Representative finds that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by University's Representative.
- D. Test sanitary drainage and vent piping according to procedures of University's Representative.
 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.

3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 15183

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 185 psig.

1.3 SUBMITTALS

- A. Product Data: For each type of refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.
- E. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

3. Indicator: Color coded to show moisture content.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

2.2 REFRIGERANTS

- A. Manufacturers:
1. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.
 3. Honeywell, Inc.; Genetron Refrigerants.
 4. INEOS Fluor Americas LLC.
 5. Or equal.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction and Liquid lines for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping adjacent to machines to allow service and maintenance.
- F. Install piping free of sags and bends.
- G. Select system components with pressure rating equal to or greater than system operating pressure.
- H. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

- I. Arrange piping to allow inspection and service of refrigeration equipment.
- J. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.

3.3 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 15062.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

END OF SECTION

SECTION 15738

SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes split-system air-conditioning consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed mounting, and shall not be connected to ducts.

1.2 SUBMITTALS

- A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

- A. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. The compressor shall have a warranty of 6 years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Mitsubishi Electronics America, Inc.; HVAC Division.
 - 2. Sanyo Fisher (U.S.A.) Corp.
 - 3. Daikin AC (U.S.A.).
 - 4. Or equal.

2.2 EVAPORATOR-FAN UNIT

- A. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.
- B. The casing shall be ABS plastic and have a Munsell 0.70Y 8.59/0.97 finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.
- C. The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds: Low, M1, M2, and Hi.
- D. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control: 100% horizontal flow, 80% horizontal flow (plus 20% downward airflow), 60% horizontal airflow (plus 40% downward airflow), 40% horizontal airflow (plus 60% downward airflow), and swing. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.
- E. Return air shall be filtered by means of an easily removable washable filter.
- F. The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall have an option of being supplied from the outdoor unit, using Mitsubishi Electric A-Control system, or equal or separate power source for indoor and outdoor units.
- G. Unit shall have condensate internal condensate pan and condensate discharge line for connection directly to drain line or connection to condensate pump.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

- A. The outdoor unit shall be compatible with the three different types of indoor units (PKA – wall mounted, PCA - ceiling suspending, and PLA - four way ceiling cassette). The connected indoor unit must be of the same capacity as the outdoor unit.
- B. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0°F, (-18°C) ambient temperature without additional low ambient controls (optional wind baffle may be required). The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) and have a maximum refrigerant tubing length of 165 feet (50 meters) between indoor and outdoor units without the need for line size changes, traps or additional oil.
- C. The outdoor unit shall be pre-charged for a maximum of 100 feet (30 meters) of refrigerant tubing.
- D. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

- E. The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection, and have a Munsell 3Y 7.8/1.1 finish.
- F. The fan grille shall be of ABS plastic.
- G. Outdoor unit shall be furnished with an AC fan motor. The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.
- H. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.
- I. The compressor shall be a DC rotary compressor with Variable Compressor Speed Inverter Technology. The compressor shall be a scroll compressor with variable speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
- J. The electrical power of the unit shall be 208volts or 230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
- K. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with sub-base to control compressor and evaporator fan.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- B. Install ground-mounted, compressor-condenser components on 8-inch thick, reinforced concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.

3.2 CONNECTIONS

- A. Connect refrigerant tubing to component's flare fittings, per manufacture's instructions. Install tubing to allow access to unit.

- B. Install piping adjacent to unit to allow service and maintenance.
- C. Connect condensate drain lines to condensate pump.

3.3 FIELD QUALITY CONTROL

- A. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- B. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL REQUIREMENTS

PART 1- GENERAL

- 1.1 SCOPE: Electrical General Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements. Work includes but is not necessarily limited to the following:
- A. The work includes but is not limited to the following:
 - 1. Provide receptacles as shown on drawings.
 - 2. Provide non-metallic raceway with associated hardware for a full installation.
 - 3. Provide telephone and data conduits.
 - 4. All temporary power and lighting during construction;
 - 5. All equipment and facilities required to provide temporary and permanent services;
 - 6. All electrical work for the building power, lighting, signal, control and life safety; except as specified herein to be furnished or installed as part of other sections of the specifications;
 - 7. Incidental items not indicated on the drawings nor mentioned in the Specifications that belong to the work described, or are required to provide complete and operable systems, as though called out here in every detail.
 - B. Work related to the mechanical trade as listed below shall be included in this Division of the work. Furnish and install the following:
 - 1. All conduit, outlets, line voltage wiring and disconnect switches required for the specified operation of the equipment.
 - 2. Connect all HVAC equipment per equipment installation diagrams.
 - C. Furnishing and installing of all hangers, anchors, sleeves, chases and supports, for all electrical materials and equipment.
 - D. Cleaning, cutting patching, repairing and painting.
- 1.2 APPLICABLE PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- A. American National Standards Institute, Inc. (ANSI) Publications:
 - 1. C2-9 National Electrical Safety Code
 - 2. C37.20-81 Switchgear Assemblies, including supp. C37.20A, C37.20B, Interfiled; C37.20D-78
 - B. State of California Administrative Codes:

1. Title 8, Industrial Relations
2. Title 19, State Fire Marshal Regulations
3. Title 24, Part 3, CCR, 2007 California Electrical Code
4. Title 24, Part 9, CCR, 2007 California Fire Code
- C. National Electrical Manufacturers Association (NEMA) Publication:
 1. ICS6 Enclosures for Industrial Controls and Systems
- D. National Fire Protection Association (NFPA) Publications:
 1. 70-05 National Electrical Code (NEC)
 2. 70B Electrical Equipment Maintenance
 3. NFPA 101 Life Safety Code
- E. State of California Public Utilities Commission (Cal. P.U.C.) Publication:
 1. G.O. 128 Rules for Construction of Underground Electrical Supply and Communications Systems

1.3 WORK SEQUENCE

- A. Install work to accommodate University's occupancy requirements. During the construction period, coordinate and update electrical outage schedule and operations with the University's Representative on a weekly basis.

1.4 DEFINITIONS: The following definitions apply to terms used on the electrical drawings and in the electrical specifications.

- A. The words "work" or "electrical work" herein include products, labor, equipment, tools, appliances, transportation and all related items, directly or indirectly required to complete the specified and indicated electrical installation.
- B. The word "concealed" shall mean that the installation will not be visible when all permanent or removable elements of the construction are in place. The word "exposed" shall mean that the installation is visible when all permanent or removable elements of the construction are in place.
- C. The word "code" shall mean any and all regulations and requirements of regulatory bodies, public and private, having jurisdiction over the work involved.
- D. The word "product" means all material, equipment, machinery, and/or appliances directly or indirectly required to complete the specified and/or indicated electrical work.
- E. The words "standard product" shall mean a manufactured product, illustrated and/or described in catalogs or brochures, which are in general distribution prior to the date of issue of construction documents for bidding.
- F. The word "provide" shall mean furnish and install and where applicable shall also mean connect, complete installation and test.

- G. The word "remove" shall mean remove and dispose of equipment or material off-site.
- H. The words "powered equipment", shall mean a complex product converting an electrical energy source to:
 - 1. Mechanical power.
- I. In each standard referenced to in the technical sections, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or other words of similar meaning, to mean University.
- J. The word "Authorized" or "Authorization" shall mean authorized or authorization by the University's Representative.
- K. Refer to Division 1, for additional definitions of words and phrases.

1.5 DISCREPANCIES

- A. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

- 1.6 CHANGES: The Contractor shall be responsible to make and obtain approval for all necessary adjustments in conduit and equipment layouts as required to accommodate the relocations of equipment and/or devices which are affected by any approved authorized changes or Product substitutions. All changes shall be clearly indicated on the "Record" drawings.

1.7 COOPERATION WITH WORK UNDER OTHER DIVISIONS

- A. The arrangement of and connection to equipment shown on the drawings is based upon information available at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The drawings are, in part, diagrammatic and some features of the illustrated equipment installations may require revision to meet actual equipment installation requirements. Structural supports, housekeeping pads, electrical connections and adjacent equipment may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions or alterations.
- B. Coordinate with work specified in other divisions to facilitate general progress of Work.
- C. Work under this Division shall follow general building construction closely. Set conduit sleeves and inserts and verify that openings for chases and conduits are provided before concrete is placed or masonry installed.
- D. Coordinate with work specified in other divisions in determining exact location of outlets, conduit, lighting fixtures, and pieces of equipment to avoid interference with lines required to maintain proper installation of work.
- E. Make such progress in the work to not delay work specified in other sections.

- 1.8 SUBMITTALS: Submit shop drawings, manufacturer's data certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval. Contractor shall be responsible for reviewing and certifying submittals as conforming to the drawings and specifications prior to submittal and shall verify conformance of equipment as delivered with final shop submittals, specifications and plans. Contractor shall report to University's Representative any deviations prior to initiation of construction. Contractor is responsible for promptly reporting to University's Representative any news of late equipment delivery which is likely or certain to delay installation.
- A. Submit shop drawings and product data grouped and referenced by the technical Section numbers.
 - B. Proposed Products List: Include Products as required by the individual section in this Division.
 - C. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the University's Representative bearing the electrical engineer's stamp of "reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site when required by the University's Representative, without additional compensation.
 - D. Shop Drawings: Drawings shall be a minimum of 8.5 inches by 11 inches in size with a minimum scale of 1/8-inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, duct work, and other items that must be shown to assure a coordinated installation. In wiring diagrams, identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, revise drawings to show acceptable equipment and resubmit.
 - E. Manufacturer's Data: For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
 - F. Standard Compliance: When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute (ANSI) or Underwriters' Laboratories (UL), submit proof of such conformance to the University's Representative for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the University's Representative. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.
 - G. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.

1.9 REGULATORY REQUIREMENTS

- A. Electrical: Conform to NFPA 70, CA PUC G.O. 95, CA PUC G.O. 128, ANSI C2, CAC Title 24, and NFPA 101 and applicable code requirements.
- B. When drawings or specifications call for materials or construction of better quality of larger size than required by codes, laws, rules and regulations, the drawings and specifications shall take precedence.
- C. Equipment not complying with applicable codes shall be removed and replaced with approved equipment at Contractor's expense. UL listing labels, where applicable, shall be installed prior to shipment from factory.

1.10 GUARANTEE

- A. Refer to General Conditions Article 12.
- B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Have manufacturer furnish replacement parts to the University as directed. Furnish manufacturer's warranties for all equipment furnished under this project.

1.11 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of University's Representative before proceeding.

1.12 OPERATION AND MAINTENANCE MANUAL: Furnish operation and maintenance manual of all equipment and lighting fixtures furnished on this project.

1.13 POSTED OPERATING INSTRUCTIONS: Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.14 MANUFACTURER'S RECOMMENDATIONS: Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.15 DELIVERY AND STORAGE: Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B P, Appendix I, titled "Equipment Storage and Maintenance During Construction." Replace damaged or defective items with new items.

- 1.16 ELECTRICAL REQUIREMENTS: Furnish internal wiring for components of packaged equipment as an integral part of the equipment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

- 3.1 Obtain and pay for all permits, and inspections, including any independent testing required to verify standard compliance, and deliver certificates for same to University's Representative. All work shall conform to the requirements of NFPA 70, CA PUC G.O. 95, CA PUC G.O. 128, Title 24, California Code of Regulations (CCR).
- 3.2 WORK RESPONSIBILITIES
- A. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural conditions. The Contractor is responsible for the correct placing of work and the proper location and connection of work in relation to the work specified in other sections.
 - B. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.
 - C. Where equipment is furnished as specified in other sections, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
 - D. Do not install light outlets or fixtures until mechanical piping and duct work is installed; then lights shall be installed in locations best suited for equipment arrangement or as approved by the University's Representative.
 - E. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the shop drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
 - F. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the University's Representative immediately and cease work on all parts of the contract which are affected until approval for any required modifications to the construction has been obtained from the University's Representative.
 - G. Perform all work with competent and skilled personnel.
 - H. All work, including aesthetic as well as electrical and mechanical aspects of the work, shall be of the highest quality consistent with the best practices of the trade.
 - I. Replace or repair, without additional compensation, and any work which, in the opinion of the University's Representative, does not comply with these requirements.

3.3 PAINTING OF EQUIPMENT

- A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.
- B. Field Applied: Paint electrical equipment as required to touch up, to match finish on other equipment in adjacent spaces or to meet safety criteria.

3.4 RECORD DRAWINGS

- A. Shop drawings shall be provided detailing location of all electrical panels, equipment, junction boxes, conduit, lighting, receptacles, and other connected devices. Panel schedules, circuit numbers and all other electrical information shall be clearly indicated on drawings. Drawings shall be in AutoCad format meeting University standards.

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit
- B. Fittings and Conduit Bodies
- C. 600 Volt Wires
- D. Boxes
- E. Wiring Devices
- F. Cabinets and Enclosures
- G. Safety Switches
- H. Fuses

1.2 RELATED SECTIONS

- A. Section 16010 - Electrical General Requirements, applies to this section, with the additions and modifications specified herein.
- B. Section 16170 - Grounding and Bonding.
- C. Section 16195 - Electrical Identification.

1.3 APPLICABLE PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute, Inc. (ANSI) Publications:
 - 1. C80.1 Rigid Steel Conduit, Zinc Coated
 - 2. C80.3-83 Electrical Metallic Tubing, Zinc Coated
 - 3. C80.5-77 Specification for Rigid Aluminum Conduit
 - 4. FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
 - 5. OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. National Electrical Manufacturers Association (NEMA) Publications:
 - 1. AB 1 Molded Case Circuit Breakers

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2. ICS 2 Industrial Control Devices, Controllers, and Assemblies
 3. ICS6 Enclosures for Industrial Controls and Systems
 4. KS 1 Enclosed Switches
 5. TC 2 Electrical Plastic Tubing and Conduit
 6. WD 1 General Purpose Wiring Devices
 7. WD 6 Wiring Device Configurations
 8. RN 1 PVC Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
- C. National Fire Protection Association (NFPA) Publication:
1. 70-05 National Electrical Code (NEC)
- D. State of California Administrative Codes:
1. Title 24, Part 3, CCR, 2007 California Electrical Code
- E. Underwriters Laboratories, Inc. (U.L.) Publications:
1. 1-85 Standard for Flexible Metal Conduit
 2. 6-81 (R86) Rigid Metallic Conduit
 3. 50-80 Cabinet and Boxes
 4. 83-1983 Thermoplastic Insulated Wires
 5. 198E-82 (R87) Class R Fuses
 6. 360-80 (R86) Liquid-tight Flexible Steel Conduit
 7. 486A-1980 (R86) Wire Connectors and Soldering Lugs, for use with Copper Conductors
 8. 498-86 (R87) Attachment Plugs and Receptacles
 9. 508-84 (R85) Industrial Control Equipment
 10. 510-77 (R82) Insulating Tape
 11. 514A-1983 (R85) Metallic Outlet Boxes
 12. 514B-1982 (R85) Fittings for Conduit and Outlet Box
 13. 651-81 Schedule for 40 & 80 Rigid PVC Conduit
 14. 797-77 Electrical Metallic Tubing
 15. 869-84 Standard for Service Equipment
 16. 1242-83 Standard for Intermediate Metal Conduit

1.4 SUBMITTALS

- A. Product Data: Provide for:
 - 1. Conduit and Connectors (all types)
 - 2. Conductors (all types)
 - 3. Cabinets, Enclosures and Junction Boxes
 - 4. Safety Switches
 - 5. Wiring Devices (receptacles and switches)
 - 6. Device Plates
- B. Test Reports: Provide for:
 - 1. Insulation resistance tests of low voltage conductors.
 - 2. Operational tests.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual routing of conduits larger than 1-1/2 inches.
- B. Accurately record actual locations and mounting heights of device, outlet, pull and junction boxes.
- C. Accurately record actual location of each new receptacle.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 and with all state adopted amendments, except where requirements herein are more stringent.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or a testing firm acceptable to University's Representative as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Division 1.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.8 PROJECT CONDITIONS

- A. The drawings are diagrammatic and shall not be scaled for exact locations: Field conditions and non-interference with other utilities and trades, shall determine exact locations.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings diagrammatically unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

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- 2.1 MATERIALS AND EQUIPMENT: Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated. Except where specifically indicated otherwise, provide only new materials having all legally required approvals and/or labels. Items of a similar nature shall be of the same type and manufacturer.
- 2.2 CONDUIT
- A. Rigid Steel Conduit (Zinc-coated): ANSI C80.1, UL 6, hot-dip galvanized, threaded type.
 - B. Electrical Metallic Tubing: UL 797, ANSI C80.3.
 - C. Rigid Plastic Conduit: NEMA TC-2, UL 651, PVC Schedule 40, Carlon or equal.
 - D. Liquidtight Flexible Metallic Conduit: UL 360, Interlocked steel construction with a polyurethane jacket, Electri-Flex Liqueflex® type CEA or equal.
 - E. PVC Coated Metal Conduit: NEMA RN 1, rigid steel conduit with external PVC coating, 40 mil thick.
- 2.3 FITTINGS
- A. Fittings for Rigid Metallic Conduit and Intermediate Metallic Conduit: UL 514B, threaded-type.
 - B. Fittings for EMT: Compression type. Split or set-screw couplings unacceptable.
 - C. Fittings for Liquidtight Flexible Metallic Conduit: ANSI FB 1.
 - D. Expansion/Deflection Fittings: Provide fitting capable of a straight line expansion movement of 2" in either direction and a movement of 3/4" from the normal in all other directions, OZ Gedney Type AXDX, or equal. Provide complete with grounding and bonding jumpers.
 - E. Fittings for PVC Coated Metal Conduit: ANSI FB 1; steel fittings with external PVC coating to match conduit.
- 2.4 CONDUCTORS: Conductors shall bear the date of manufacture imprinted on the insulation with other identification. Wire and cable manufactured more than 6 months before delivery to the job site shall not be used.
- A. 600 Volt Wires and Cables: UL 44, ICEA S-66-524, NEMA WC-7. Conductors shall be stranded copper per ASTM B-3 or B-8. Insulation shall be type THWN unless otherwise noted. Conductors 250 kcmil or larger shall be type XHHW.
 - B. Color Coding: Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:
 - 1. 208Y/120 Volt, 3Ø:
 - a. Phase A - black
 - b. Phase B - red
 - c. Phase C - blue

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- 2. 480Y/277 Volt, 3Ø:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - C. Minimum size for branch circuits shall be No. 12 AWG, unless otherwise noted.
- 2.5 OUTLET BOXES
- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
 - C. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Provide gasketed cover and threaded hubs by box manufacturer.
- 2.6 RECEPTACLES: UL 498 and NEMA WD 1
- A. Receptacles shall be white NEMA 5-20R, meeting or exceeding Hubbell type CR5362 specifications unless otherwise indicated on the drawings. Manufacturers: Hubbell, Leviton and Pass & Seymour, or equal.
 - B. Weatherproof Receptacles: For flush mounted weatherproof convenience outlets, provide duplex receptacles as listed above with gasketed stainless steel cover plate and gasketed cap over each receptacle opening. Where surface mounted, use cast box with gasketed cast aluminum plate having duplex lift covers. Receptacles shall be UL listed for use in "wet locations."
 - C. All receptacles located in counter top surfaces in kitchen area, within 6 feet of the sink, toilets, electrical room and on exterior of building shall be GFCI type. In addition to this requirement, provide GFCI type receptacles where indicated on the drawings or required by code.
- 2.7 SWITCHES: NEMA WD 1
- A. General purpose wall switches shall be heavy-duty, 20A, 277V AC, general use snap switch with ivory handle. Provide single pole, 2-pole, 3-way, 4-way, momentary contact, weatherproof, lock or other type switches indicated. Manufacturers: Hubbell, Leviton and Pass & Seymour, or equal.
 - B. AC Manual Motor Starting Switches: UL 508. Manufacturers: Hubbell, Leviton, Square D, or equal.

2.8 DEVICE PLATES

- A. Provide UL listed, one-piece device plates for all wiring devices, for telecommunications outlets and for outlet boxes used as junction or pull boxes. Plates shall be 302/304 stainless steel having round or smooth edges. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."
- B. In addition to the requirements specified in Section 16195, provide nameplates with 3/16" high block letters, black enamel filled, machine engraving for new device plates under any of the following conditions listed below. Use designations indicated or select words to best describe purpose of each device.
 - 1. Plates containing more than three switch devices.
 - 2. Selector switches.
 - 3. Manual motor starting switches.
 - 4. Special outlets where indicated.

2.9 CABINETS: UL 50.

- A. Cabinets for same type of use shall be the product of a single manufacturer.
- B. Construct of cold-rolled drawing quality steel, with metal gages and construction methods conforming to National Electrical Code requirements, and Underwriters Laboratories' standards. Provide 12 gauge G-90 grade galvanized steel minimum, unless otherwise noted.
- C. Finish doors, trims, and back boxes for surface-mounted cabinets in finished areas by applying a rust-resistant treatment, prime coat, and a final coat of manufacturers standard enamel or lacquer finish. Galvanize all other sheet metal components of cabinets including back boxes for flush cabinets, excepting non-ferrous metal parts, or steel parts provided with cadmium plating or equivalent protective plating.
- D. Equip doors with concealed or semi-concealed hinges and with flush or semi-flush spring catch type flush cylinder locks. Key cabinet doors of similar use alike, and provide two keys with each lock.
- E. Equip cabinets for use with telephone, alarm or signal systems with a 0.5" thick plywood fire-rated backboard. Equip cabinets with terminal strips where so specified. Equip cabinets with nameplates.
- F. Surface cabinets shall be furnished without knockouts. Punch or drill required openings during installation. Equip flush back boxes with manufacturer's standard pattern of knockouts.
- G. Equip cabinet doors exceeding 40" in height with vertical bolt three point locking mechanisms.
- H. Manufacturers:
 - 1. Cabinets for general use: Hoffman Engineering Co., Square D, or Columbia Manufacturing Co., or equal.

2. Cabinets for systems and/or products, use cabinets furnished by manufacturer with system or product. Where system or product cabinets do not comply with these Specifications, submit cabinet shop drawings, indicating deviations, and obtain approval for their use.

2.10 JUNCTION BOXES AND PULL BOXES: UL 50.

- A. Provide pull and junction boxes sized as indicated or required. Provide 16 gauge steel minimum, unless otherwise noted. Indoor enclosures shall conform to NEMA ICS 6 for the Type 12, unless otherwise noted.
- B. Size junction and pull boxes to not less than minimum NEC requirements. Increase size above NEC requirements where necessary to provide space for pulling, racking or splicing enclosed conductors, or where specified or indicated dimensions exceed NEC requirements.
- C. Fabricate sheet metal junction and pull boxes of galvanized sheet steel. Include angle iron framing where required for rigidity. Boxes shall not deflect or deform visibly when covers are removed after conduit and conductors are installed, and any deflection occurring shall not prevent the easy installation and removal of cover attachment screws.
- D. Do not use single covers for junction and pull boxes having cover length or width dimension exceeding three feet unless so specified, indicated, or approved. Sectionalize covers that exceed three feet in either dimension into two or more sections.
- E. Equip metal junction and pull boxes exposed to weather (and not installed in or below grade) with raintight or weatherproof removable covers. Enclosures shall conform to NEMA ICS 6 for the Type 4, unless otherwise noted. Rain tight or weatherproof boxes shall be used threaded watertight hubs for top or side entry and may use knockout for bottom entry only. For exterior pull boxes, use a minimum of 14 gage galvanized G-90 grade sheet steel.
- F. Use concrete junction and pull boxes for exterior underground conduit unless otherwise specified or indicated. Use steel plate or cast iron covers and rims in no traffic areas, and cast iron covers and rims designed for AASHTO Class H20 wheel loading wherever vehicular traffic will occur.
- G. For interior junction and pull boxes located in concrete floors, and 24" square or smaller, use cast iron boxes with integral cast tapped conduit hubs, and having recessed cover flush in the box trim placing all elements of the face of the box flush in the plane of the surrounding floor. Equip boxes with watertight covers where so indicated.
- H. For interior pull boxes located in concrete floors and larger than 24" square, use precast concrete boxes or form these boxes at the job site. Equip with angle iron cover rim, and with reinforced steel cover plate set flush with the finish floor plans. Specific plan details shall supersede these general requirements.
- I. Equip grade level exterior pull boxes with a sump, and with knockouts for conduit on sides and ends. Coordinate requirements for conduit openings with underground conduit requirements. Identify the covers of exterior grade level junction and pull boxes with the work "ELECTRIC" cast into or otherwise permanently inscribed in the metal of the cover. Equip exterior grade level pull boxes with pull irons where so indicated. Boxes shall set on 24" crushed gravel base.

- J. Equip surface sheet metal junction and pull boxes with covers aligning with the sides of the boxes and equip flush boxes with covers extending 3/4" all around the perimeter of the back box. Provide sufficient cover attachment screws to ensure that box covers will contact the surface of the box for the entire perimeter of the enclosure. Use galvanized or cadmium-plated screws, or brass screws to attach covers to boxes.
- K. Use brass screws to attach junction and pull box covers to interior floor boxes or to boxes located where moisture may be present.
- L. Manufacturers:
 - 1. Sheet steel junction and pull boxes: Hoffman Engineering Co., Pico Metal Products Co., or equal.
 - 2. Cast iron junction and pull boxes: O.Z. Electric Manufacturing Co., Alhambra Foundry Co., Ltd., Crouse Hinds Co., or equal.
 - 3. Concrete junction and pull boxes: Brooks Products Inc., Jensen Co., Utility Vault, or equal.

2.11 SAFETY SWITCHES

- A. NEMA KS 1. Switches serving as a motor-disconnect shall be horsepower rated. Provide heavy-duty type switches. Fused switches shall utilize Class R fuseholders and fuses unless indicated otherwise. Unless otherwise indicated, provide indoor switches in NEMA Type 12 enclosure, per NEMA ICS 6. Provide outdoor switches in NEMA Type 4 enclosure, per NEMA ICS 6. Provide switches for the number of poles and the voltage, current and horsepower ratings as required.
- B. Provide each switch with laminated plastic nameplate indicating panel designation and circuit number of the feeder and equipment controlled.

2.12 WIRE CONNECTORS AND TERMINALS: For use with copper conductors. UL 486A.

2.13 INSULATING TAPES: UL 510.

2.14 NAMEPLATES: Provide as specified in Section 16195, "Electrical Identification."

PART 3 - EXECUTION

3.1 INSTALLATION: Electrical installation shall conform to requirements of NFPA 70, state and local codes, and to requirements specified herein.

3.2 LOCATIONS

- A. The drawings indicate diagrammatically the desired locations and arrangements of the components of the electrical work. Follow the drawings as closely as possible, but use judgment and coordinate with other trades to secure the best possible installation in the available space and under the developed conditions.

- B. Before installing any equipment, conduit, or locating any outlet, examine the complete set of documents, including shop drawings and specifications, and verify all dimensions and space requirements. Make such minor adjustments as may be necessary to fit the building structure and accommodate the work of other trades. Install all electrical work to preserve legal headroom, access, work space, clearances and to keep openings and passage ways clear. Arrange for additional space if required for the servicing, maintenance, and replacement of the electrical equipment.
- C. Control devices shall not be mounted more than 6'-6" above the floor.
- D. Prior to installation, the University reserve the right to relocate any outlet or device within six feet of the location indicated on the plans and at no additional cost to the University.
- E. No additional compensation will be allowed for omissions, inadequate space, misunderstandings or rejected work caused by neglect of these requirements.

3.3 CONDUIT

- A. Rigid steel conduit shall be used for circuits greater than 600 volts installed above grade and may be used in all locations unless otherwise indicated.
 - 1. Rigid steel conduit shall not be installed below grade in direct contact with earth, except where used as a riser where it shall be wrapped with approved black pipe tape.
 - 2. Provide "DANGER - HIGH VOLTAGE" labels on exposed conduits containing circuits greater than 600 volts. Refer to Section 16195.
- B. Electrical metallic tubing (EMT) may be installed in indoor dry locations only. Restrictions applicable to EMT:
 - 1. Do not install below grade.
 - 2. Do not encase in concrete.
 - 3. Do not use in areas subject to severe physical damage (including, but not limited to, mechanical equipment rooms and electrical equipment rooms).
 - 4. Do not use outdoors.
- C. PVC Schedule 40 conduit may be used underground within the building perimeter (below 600V):
 - 1. The top of the duct shall not be less than 24 inches below grade.
 - 2. Risers shall be galvanized rigid steel where exposed.
- D. Use flexible conduit in short lengths for final connections to lighting fixtures in accessible ceilings, motors, transformers and other vibration type equipment. Provide green ground conductor in all flexible conduit.
- E. Install conduit in accordance with NECA "Standard of Installation." The electrical drawings are diagrammatic and do not show all offsets, bends, fittings, junction boxes, pull boxes and expansion fittings required to meet field conditions. Determine actual material and hardware requirements and verify all dimensions by field inspection.

- F. Arrange supports to prevent misalignment during wiring installation.
- G. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- H. Group related conduits; support using conduit rack. Construct rack using steel channel provide space on each for 25 percent additional conduits.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls.
- K. Maintain adequate clearance between conduit and piping.
- L. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees.
- M. Cut conduit square using saw or pipecutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Provide pull fittings in all overhead conduit runs exceeding 200 feet of straight conduit, or having more than the equivalent of three 90 degree bends. Each 90 degree bend shall be considered the equivalent of 50 feet of straight run. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size.
- P. Where conduit passes across a seismic joint or where there is a possibility of dissimilar movements, an expansion/deflection device or a suitable loop of flexible conduit shall be installed. Looped flexible conduit shall consist of 18" minimum length of looped conduit with a junction box at one or both ends to withstand a minimum deflection of 4". Refer to structural drawings for seismic joint locations.
- Q. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- R. Provide 1/8" diameter polyethylene pull line in each spare conduit except sleeves and nipples.
- S. Conduit which penetrates fire walls, fire partitions, or floors shall be metallic on both sides of fire walls, fire partitions, or floors for minimum distance of 6 inches. Restore fire rating integrity at conduit penetration. All holes created to extend electrical systems through fire rated floors and walls shall be sealed by the electrical contractor with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250°F. It shall be UL Classified and have I.C.B.O., B.O.C.A.I. and S.B.C.C.I. (NRB 243) approved ratings to three hours per ASTM E-814 (UL 1479). Manufacturers: 3M, Carborundum, Hevi-Duty/Nelson, or equal.
- T. Where conductors of No. 4 AWG or larger are to be installed in a conduit, or where any conductors are to be deflected more than 30 degrees when leaving a conduit, terminate the conduit with an insulating bushing.
- U. Ground and bond conduit under provisions of Section 16170.

3.4 600 VOLT CONDUCTORS

- A. Splices:
 - 1. Splices in conductors #8 AWG and smaller shall be made with "Scotchlok" insulated connectors or equal of proper size for conductors being spliced.
 - 2. Splices in conductors #6 AWG and larger shall be made with pressure type solderless connectors. Use approved cold shrink splice kits.
- B. Connectors and terminal lugs shall be used for terminating stranded conductors #6 AWG and larger and shall be T&B, IlSCO, or equal solderless connectors.
- C. Wire in panels, cabinets, pull boxes and wiring gutters shall be neatly grouped, strapped together with T&B Model Tyrap cable strap, or equal or laced with #12 stranded lacing twine and fanned out to the terminals.
- D. Neutral conductor shall be continuous in outlet boxes and shall not be broken by addition or removal of devices.
- E. Wiring methods in return air plenum spaces shall comply with NEC 300-22.

3.5 FITTINGS

- A. Use threaded fittings for rigid metal conduit and compression fittings for tubing.
- B. Use cement-on fittings for plastic conduit.
- C. Fittings for flexible conduit shall be of the threadless hinged clamp type. Do not use fittings threaded internally into the flexible conduit ends.
- D. Use fittings made of the same material as the raceway except:
 - 1. Malleable iron and steel are interchangeable.
 - 2. Die cast fittings may be used for flexible steel conduit and for factory manufactured offsets.
 - 3. Use aluminum fittings only with aluminum conduit.
 - 4. Use plastic insulated bushings for conduit sizes larger than 1".
 - 5. Use insulated throat connectors for electrical metallic tubing.

3.6 CABINETS

- A. Set cabinets at heights indicated or specified. In the absence of such information, set cabinets at not to exceed 6'-6" from finish floor to top of cabinet.
- B. Align tops of cabinets in sight of each other at a uniform height.
- C. Install cabinets and other enclosure products in plumb with the building construction. Install flush enclosures so that the trim will rest against the surrounding surface material around the entire perimeter of the enclosure.
- D. Where cabinets are located in poured-in-place concrete wall construction, brace internally with temporary wood or other bracing to prevent deformation of the back or sides of the enclosure.

- E. Do not locate cabinets (or other electrical enclosures) where room doors will touch enclosure face when room door is opened 180°. Locate cabinets (and other enclosures) so that enclosure door can be opened through a minimum 180° arc, except that the arc may be reduced to 130° for enclosures mounted to wireways. Do not install surface mounted cabinets in finished areas, unless so indicated. Where conflicting data is indicated, verify mounting requirements prior to ordering cabinets.

3.7 WIRING DEVICES

- A. Use products of a single manufacturer for each type of wiring device. Different manufacturers may be used for different type devices, if the requirements of the specification are fulfilled.
- B. Use the products of a single manufacturer for all device plates. Obtain prior approval for any variations from this requirement except that plate variations are allowed for the following devices:
 - 1. Where the selected plate manufacturer does not manufacture a suitable finish plate.
 - 2. For heavy-duty receptacles rated at more than 30 amperes.
 - 3. Where the raceway system enclosure employs a non-standard finish plate.
 - 4. Where non-standard plates are specified or indicated.
- C. Where pilot lights are indicated, use LED lamp and jewel type lens mounted in the same outlet as the switch, with common finish plate. Pilot lights shall be "on" when controlled load is "on".
- D. Substitute key operations for toggle where locking switches are indicated. Provide not less than two keys for each such switch, except not more than ten keys of the same pattern for the total project. Use only keys that are compatible with key system established for site.
- E. Position receptacles so that the ground contact in grounding type receptacles is on the bottom of parallel prongs.
- F. Install adjacent devices of the same type and with the same mounting height in a common outlet box.
- G. Prior to installation of switch outlets, examine plans and verify locations.
- H. Counter top receptacles shall be mounted 4" above the finish surface.
- I. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with specialty building equipment requiring very exact electrical rough-in.

- 3.8 **BOXES, OUTLETS AND SUPPORTS:** Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 7 feet above interior floors, when installed under raised floor or when installed in hazardous areas. Boxes in other areas shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in the box. Provide gaskets for cast-metal boxes installed in wet locations.

3.9 JUNCTION AND PULL BOXES

- A. Wherever possible use outlet boxes for junction and pull boxes.
- B. Locate interior junction and pull boxes in machine rooms, equipment rooms, storage rooms, electrical rooms and similar utility spaces unless otherwise indicated or approved. Where junction or pull boxes must be used in finished areas, use flush boxes only equipped with prime finished sheet metal plates. Fasten plates to boxes with countersunk flat head screws. Provide plates with 3/4" trim all around.
- C. Do not use sectionalized boxes except where indicated. Do not mix feeder and branch circuit conductors in a common pull or junction box.
- D. Where more than one circuit passes through a common junction or pull box, tag conductors and label covers to indicate circuit number and panel designation.
- E. Circuit numbers shall be labeled on all covers.

3.10 OPENINGS, CHASES AND SLEEVES

- A. Provide openings, chases, cutting, patching, sleeves and other products, necessary to permit the electrical raceways and cables to pass through the structure.
- B. Establish locations for openings, chases and sleeves sufficiently in advance of construction to avoid cutting and patching. Perform any required cutting and patching for electrical work and obtain approval for cutting from University's Representative prior to work being done.
- C. Repair damages to finished work and surfaces caused by cutting, to the satisfaction of University's Representative.
- D. Install sleeves wherever raceways of any type pass through walls or floors above grade, except that sleeves are not required for drywall construction or laid up masonry construction used for interior partitions and not fire rated.
- E. Use pipe or sheet steel sleeves for interior dry locations.
- F. Install sleeves with both ends flush with wall surfaces and with upper ends 3" above floor surfaces. Install bottom end of floor sleeves flush with slabs if not concealed by ceiling system. Use steel pipe sleeves through floors.
- G. Furnish galvanized steel 24 gauge roof jacks and pitch dams for roof penetrations. For installation of roof jacks and pitch dams (pockets), refer to Architectural drawings. Size roof jacks to extend 6" out on roof and 8" up conduit above roof. Solder or braze a flashing collar to conduits passing through roof jacks. Size pitch dams to extend 6" above roof and 6" beyond roof opening.
- H. Core drill existing concrete walls or slabs to pass new runs of conduit or tubing. Seal core drilled openings as described for sleeves.
- I. For exterior walls below grade conduit entries, use manufacturer fabricated wall entrance seals.

- 3.11 **MOUNTING HEIGHTS:** Mount disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor or platform. When installing switch next to existing switch, match mounting height of existing switch.

3.12 FIELD TESTS: As an exception to requirements that may be stated elsewhere in the contract, the Inspector shall be given minimum 5 working days notice prior to each test. The Contractor shall provide all test equipment and personnel and submit written copies of all test results.

- A. Distribution Conductors, 600 Volt Class: Test all conductors #8 AWG and larger to verify that no short circuits or accidental grounds exist. Tests shall be made using an instrument which applies a voltage of approximately 500 volts and provides a direct reading of resistance in ohms. Resistance readings of "infinite" value will not be accepted. Insulation resistance, corrected to 60°F, shall not be less than the following values:

250-750 kcmil	50 megohms
4-4/0 AWG	50 megohms
8-6 AWG	100 megohms

Record resistance readings, temperature and weather conditions on the test form. After testing is completed and witnessed by University's Representative, submit test form within 14 days.

- B. Operational Tests: Demonstrate the operation of each switch, relay and other item of electrical control with the system fully energized and operating. Each shall be demonstrated three times. Any faulty or defective Contractor furnished materials and workmanship found during the tests shall be replaced or corrected by the Contractor at no additional cost to the University.

END OF SECTION

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 APPLICABLE PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. Institute of Electrical and Electronic Engineers (IEEE) Publication:
 - 1. 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- B. National Fire Protection Association (NFPA) Publication:
 - 1. 70-05 National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (U.L.) Publication:
 - 1. 467 Grounding and Bonding

1.3 GROUNDING ELECTRODE SYSTEM

- A. Rod electrodes.
- B. Concrete – encased electrodes.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: Less than or equal to 5 ohms unless otherwise indicated.

1.5 SUBMITTALS

- A. Submit under provisions of Section 16010, Paragraph 1.10.
- B. Product Data: Provide data for the following:
 - 1. Grounding electrodes
 - 2. Conductors
 - 3. Connections (all types)
- C. Test Reports: Indicate overall resistance to ground and resistance of each exposed electrode.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

E. Submit manufacturer's qualifications per Paragraph 1.7A below.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to University's Representative as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated. Except where specifically indicated otherwise, provide only new materials having all legally required approvals and/or labels. Materials shall conform to the requirements of UL 467 where applicable.

2.2 ROD ELECTRODE

A. Material: Copper clad steel.

B. Diameter: 3/4 inch, unless otherwise indicated.

C. Length: 10 feet, unless otherwise indicated.

2.3 CONDUCTOR

A. Ground and bonding conductors shall be soft-drawn stranded copper conductors, unless otherwise indicated, installed with sufficient slack to avoid breaking due to settlement and movement of conductors or attached points.

B. System grounding conductors shall be minimum of 4/0 AWG copper, unless otherwise indicated, and shall be continuous with no joints or splices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION: Provide grounding and bonding in accordance with the requirements of NFPA 70, IEEE 142, state and local codes, and to requirements specified herein. Codes shall be complied with as a minimum requirement with specifications prevailing when they are more stringent.

A. Grounding Electrode System:

1. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
2. Grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which periodic testing is required, shall be made by exothermic type process weld (Cadweld, Thermoweld or equal). Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable.
3. Main service neutral shall be grounded to a continuous metallic cold water main and solidly grounded to ground electrode.

B. Bonding

1. Metallic conduits, wireways, metal enclosures of busways, cable boxes, electrical equipment housings, cable racks in manholes and all non-current carrying metallic parts shall be grounded. The metallic conduit system shall be used for equipment and enclosure grounding but not as a system ground conductor. Include a code sized green insulated copper grounding conductor in nonmetallic conduits and terminate each end on suitable lug, bus, or bushing.
2. All conduit stub-ups shall be grounded and where multiple stub-ups are made within an equipment enclosure, such as a switchboard, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
3. Bond together each metallic raceway, pipe, duct and other metal object entering the building. Use 2 AWG bare copper conductor.

C. Equipment Ground

1. Flexible conduit shall not be used as a ground path. Include code sized green conductor in all flex conduit.
2. Provide bonding devices, fittings or jumpers at expansion fitting, isolation sections or wherever continuity of ground is broken.

3.3 FIELD TESTS: As an exception to requirements that may be stated elsewhere in the contract, the Inspector shall be given 5 working days notice prior to each test. The Contractor shall provide all test equipment and personnel and submit written copies of all test results.

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Warning Signs.

1.2 APPLICABLE PUBLICATIONS: The following publications form a part of this specification. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute, Inc. (ANSI) Publications:
 - 1. C2-97 National Electrical Safety Code
 - 2. Z35.1-97 Safety Color Code
 - 3. Z35.2-97 Environmental and Facility Safety Signs
 - 4. Z35.5-97 Accident Prevention Tags (for Temporary Hazards)
- B. State of California Administrative Code:
 - 1. Title 8, Industrial Relations
 - 2. Title 24, Part 3, CCR, 2007 California Electrical Code
- C. National Fire Protection Association (NFPA) Publication:
 - 1. 70-05 National Electrical Code (NEC)

1.3 SUBMITTALS

- A. Product Data for:
 - 1. Nameplates
 - 2. Wire/Cable markers
 - 3. Conduit markers
- B. Provide Field Samples for:
 - 1. Nameplates: (1) sample
 - 2. Wire/Cable markers: (1) sample

3. Conduit markers: (1) sample

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Nameplate designations shall clearly state:
 1. Manufacturer's nameplate including equipment design rating of current, voltage, kVA, HP, bus bracing rating, or as applicable.
 2. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for kVA, amperes, HP and RPM as applicable.
 3. Circuit numbers on receptacles and lighting switches (wiring devices): Panel designation and circuit number. Designations may be engraved.
- B. Nameplates shall be melamine plastic, 0.125-inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering into the black core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches except that wiring device nameplates shall be 0.5 inch by 1.5 inch. Lettering shall be normal block style unless otherwise noted.
- C. Letter Size:
 1. Use 0.25 inch letters for identifying individual equipment and loads.
 2. Use 0.50 inch for identifying grouped equipment and loads.

2.2 WIRE MARKERS

- A. Description: Heat shrinkable, flame-retarded, crosslinked polyolefin wire marker. Wire tags shall have a dielectric strength of 500 V/mil minimum and a temperature range from -30°C to 105°C. Thermoplastic or wraparound tags are not acceptable. All tags shall be printed using a 9 or 24 pin dot matrix printer. Raychem ShrinkMark™, Brady Permasleeve or equal.
- B. Legend:
 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

- 2.3 CONDUIT MARKERS: ANSI Z35.1 G.2. Pressure-sensitive, adhesive-backed vinyl markers with fade-proof ultraviolet inhibitors, black characters on orange background. 2.25" x 9" marker with 1.5" high letters. Marker shall read "4160 VOLTS" or "12000 VOLTS" depending on circuit phase-to-phase voltage. Carlton Industries type EM-1, Seton Code Electrical Markers style AA, Brady B-500 series or equal.

2.4 WARNING SIGNS: ANSI Z35.1, Z35.2 and Z35.5.

- A. Warning signs shall be minimum 18 gauge steel white porcelain enamel finish with red lettering. Lettering to read "DANGER - HIGH VOLTAGE" with "DANGER" in 1-1/2" letters and "HIGH VOLTAGE" in 1" letters. New warning signs shall be provided on door/gate or immediately above door of all electrical equipment rooms, vaults, closets or outdoor substations containing equipment energized above 150 volts to ground, except where such spaces are accessible from public areas.
- B. Warning designations in 1" red letters shall be painted by stencil or pre-printed adhesive on each new pull box or cabinet stating "DANGER" and giving voltage of enclosed conductors such as "DANGER - 12,000 VOLTS", for all systems over 150 volts to ground.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.
- B. Coordinate installation of nameplates, markers and warning signs with the sequence of painting. Refer to Section 09900, "Painting."

3.2 NAMEPLATES

- A. Provide laminated plastic nameplates for all electrical equipment and devices including, but not limited to, the following:
 - 1. Enclosures for switchgear, medium voltage controllers, transformers, low voltage switchgear, motor control centers, variable frequency drives, panels, panelboards, busway, pull boxes, junction boxes, cabinets and motors.
 - 2. Enclosures for all separately enclosed devices including but not limited to disconnect switches, circuit breakers, contactors, time switches, control stations and relays.
 - 3. All receptacles and lighting switches.
 - 4. Special systems such as but not limited to telephone, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator, and pull box.
 - 5. Devices mounted within and part of an equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
- B. MOUNTING: Provide number, location, and letter designation of nameplates as indicated. Install nameplate parallel to equipment lines. Fasten nameplates to enclosures with a minimum of two sheet-metal screws or two rivets. Fasten nameplates to device plates with approved adhesive. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations. Submit adhesive for approval prior to use.

3.3 WIRE MARKERS: Provide markers for each conductor at panelboard gutters, pull boxes, junction boxes, outlet boxes, and each load connection.

3.4 CONDUIT MARKERS: Provide markers on all exposed conduit for circuits greater than 600 volts. Provide markers at lengths not greater than 20 feet on center.

- 3.5 **WARNING SIGN MOUNTING:** Signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Panelboards.

1.2 RELATED SECTIONS

- A. Section 16050 - Basic Materials and Methods.
- B. Section 16170 - Grounding and Bonding.
- C. Section 16195 - Electrical Identification.

1.3 APPLICABLE PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. National Electrical Contractors Association (NECA) Publication:
 - 1. Standard of Installation.
- B. National Electrical Manufacturer's Association (NEMA) Publications:
 - 1. NEMA AB 1 Molded Case Circuit Breakers.
 - 2. NEMA ICS 2 Industrial Control Devices, Controllers, and Assemblies.
 - 3. NEMA PB 1 Panelboards.
 - 4. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- C. National Fire Protection Association (NFPA) Publication:
 - 1. 70-05 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (U.L.) Publications:
 - 1. 50-80 Cabinet and Boxes
 - 2. 67-79 Standard for Panelboards
 - 3. 869-84 Standard for Service Equipment

1.4 SUBMITTALS

- A. Product Data: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- C. Submit proof of manufacturer's qualifications specified herein.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.6 MAINTENANCE MATERIALS

- A. Provide two panelboard keys with maximum of 24 of each type.

PART 2 - PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT: Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated. Except where specifically indicated otherwise, provide only new materials having all legally required approvals and/or labels. Items of a similar nature shall be of the same type and manufacturer.

2.2 MANUFACTURERS

- A. Square D
- B. Cutler-Hammer
- C. General Electric
- D. Or equal.

2.3 PANELBOARDS

- A. Panelboards: UL 50, UL 67, NEMA PB1, circuit breaker type, size and number of breakers as indicated.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated.
- D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, ambient compensated, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Where main breaker is shown as non-automatic, it shall be equipped with high magnetic trip with same interrupting capacity as all branch circuit breakers.

- E. Enclosure: NEMA PB 1, Type 1 or as indicated.
- F. Cabinet box: 6 inches deep; width: 20 inches.
- G. Cabinet Front: Flush or surface cabinet front as indicated with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- H. Cover shall have a permanently mounted marking stating: WARNING – Potential Arc-Flash Hazards Exist While Working On This Equipment.

PART 3 - EXECUTION

- 3.1 **INSTALLATION:** Electrical installation shall conform to requirements of NFPA 70, state and local codes, and to requirements specified herein.
 - A. Install panelboards in accordance with NEMA PB 1.1 and NECA Standard of Installation.
 - B. Align and level panelboards and securely fasten to the building. Do not use connecting conduits to support the panelboards. Install trim plumb and square.
 - C. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.
 - D. Provide filler plates for unused spaces in panelboards.
 - E. Provide typed circuit directory for each branch circuit panelboard affected by work under this contract. Revise directory to reflect circuiting changes required to balance phase loads.
 - F. Provide engraved plastic nameplates under the provisions of Section 16195.
 - G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 1-inch. Identify each as SPARE.
- 3.2 **FIELD QUALITY CONTROL**
 - A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.
 - B. Field inspection and testing will be performed in accordance with NETA and ANSI C37 standards.
- 3.3 **SPARE PARTS**
 - A. Provide the University four (4) spare circuit breakers loose for each provided size and type 225 ampere and below, and one (1) spare for circuit breakers each size and type above 225 ampere.

END OF SECTION

SECTION 16511

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Lighting fixtures, lamps, and ballasts.
 - 2. Lighting fixture supports.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.
- B. Retain first paragraph below for custom lighting fixtures.
- C. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures.
- E. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the University's Representative, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.2 BALLASTS

- A. Electronic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 - 1. Sound Rating: A.
 - 2. Total Harmonic Distortion Rating: Less than 20 percent.
 - 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 4. Operating Frequency: 20 kHz or higher.
 - 5. Lamp Current Crest Factor: 1.7 or less.
 - 6. BF: 0.85 or higher.
 - 7. Power Factor: 0.95 or higher.
- B. Ballasts for Bi-Level Controlled Lighting Fixtures with Linear Fluorescent Lamps: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.
- D. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher, unless otherwise indicated.
 9. Power Factor: 0.95 or higher.
 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 11. Ballast Case Temperature: 75 deg C, maximum.

2.3 LAMPS

- A. T8 Rapid-Start low-mercury Fluorescent Lamps: Rated for 32 W maximum, nominal length of 48 inches, 2950 initial lumens (minimum), CRI 82 (minimum), color temperature 4100 K, and average lamp life of 20,000 hours, unless otherwise indicated.
- B. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 82 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated. See luminaire schedule for type and wattage.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

- E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Brace to limit swinging per California Building Code.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Provide the University 10% spare of all lamps used on this project.

END OF SECTION

SECTION 16710

TELECOMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Related Sections
- B. Scope
- C. Codes and Specifications.
- D. Qualifications of Contractor
- E. General Requirements and Conditions.
- F. Product Requirements.
- G. Structured Cabling System.
- H. Submittals.
- I. Record Drawings.
- J. Definitions.

1.2 RELATED SECTIONS

- A. Contract Terms and Conditions.
- B. Section 16715 – Telecommunications Testing.
- C. Section 16720 – Telecommunications Basic Materials and Methods.
- D. Section 16725 - Telecommunications Cable.

1.3 SCOPE

- A. Scope of Work
 - 1. The scope of work includes the provision, installation, testing, and documentation of additional pathways and cabling systems as shown and specified for data systems for the existing School of Dentistry Building.
 - 2. The Contractor shall provide all labor, materials, tools and equipment, necessary for the satisfactory and timely completion of the project. This project includes equipping four telecom rooms (B Level, A Level, Second and Seventh Floors) with the prescribed ladder racking, equipment racks, bonding of these items to a new bus bar and installing all terminating equipment and terminating the horizontal and backbone cables. It also includes providing new pathways comprised of EMT conduits, wire mesh cable trays, non-metallic molding and communications poles. It includes horizontal Category 6 cabling to new communications outlets as noted on the plans. The Contractor shall be responsible for placing any ReadySleeve assemblies or equal required when penetrating walls. The Contractor shall be responsible for testing the new cabling that is placed on this project.

3. One other important condition the Contractor will be required to follow: Ceilings - Contractor shall contain work to a manageable area (example: 1-3 floors at a time) that will allow areas of ceiling opened to allow for the installation of conduit and cabling to be closed within a reasonable timeframe.
4. The Contractor shall provide all Record Drawings as noted in Paragraph 1.10 below.

1.4 CODES AND SPECIFICATIONS

- A. All work shall be performed in compliance with all Applicable Code and Requirements, including the following:

1. National Fire Protection Association
 - a. NFPA 70 - National Electric Code.
 - b. NFPA 101 - Life Safety Code.
 - c. NFPA 258 - Standard Test Method for Measuring Smoke Generated by Solid Materials.
2. ANSI Specifications:
 - a. ANSI C2 - National Electrical Safety Code.
 - b. ANSI/ICEA S-83-596 - Fiber Optic Premises Distribution Cable Technical Requirements.
3. Electronics Industry Alliance/Telecommunications Industry Association (TIA/EIA):
 - a. TIA/EIA TSB 72 - Centralized Optical Fiber Cabling Guidelines.
 - b. TIA/EIA 75 – Additional Horizontal Cabling Practices for Open Offices.
 - c. TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - d. TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - e. EIA-310-D - Cabinets, Racks, Panels, and Associated Equipment.
 - f. TIA/EIA 526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
 - g. TIA/EIA 455-57A - Optical Fiber End Preparation and Examination.
 - h. TIA/EIA 455-59 - Measurement of Fiber Point Defects Using and OTDR.
 - i. TIA/EIA 455-60 - Measurement of Fiber Cable Length Using an OTDR.
 - j. TIA/EIA 455-61- Measurement of Fiber Cable Attenuation Using an OTDR.
 - k. TIA/EIA 455-95 - Absolute Optical Power Test for Optical Fibers and Cables.
 - l. EIA RS-458A Standard Optical Waveguide Fiber Material Classes and Preferred Sizes.
 - m. EIA-472 Generic Specification for Optical Waveguide Fibers.

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- n. EIA 232-C.
 - o. TIA/EIA – 568 Commercial Building Telecommunications Cabling Standard.
 - p. TIA/EIA – 569 Commercial Building Standard for Telecommunications Pathways.
- 4. Federal Communications Commission (FCC) Part 15 and Part 68.
 - 5. Title 24 - State of California Code of Regulations.
 - 6. Uniform Building Code and UBC Specifications.
 - 7. Occupational Safety and Health Act (OSHA) Specifications.
 - 8. City or County Electrical Code, as applicable.
 - 9. IEEE Specifications:
 - a. IEEE 802.2.
 - b. IEEE 802.3.
 - 10. NEMA VE1 Cable Tray Systems.
 - 11. Underwriters Laboratories Specifications:
 - a. UL 497 Electrical Grounding and Bonding Equipment.
 - b. UL 1479 Fire Tests of Through-Penetration Firestops.
 - c. UL Building Materials Directory; Through-Penetration Firestops Systems, and Fill, Void or Cavity Materials.
 - 12. ASTM Specifications:
 - a. ASTM E 814 Methods of Fire Tests of Through-Penetration Fire Stops.
- B. Electronics Industry Alliance/Telecommunications Industry Association (EIA/TIA)
- 1. TIA/EIA-568-B - Commercial Building Telecommunications Cabling Standard
 - 2. TIA/EIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - 4. EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 5. EIA -310-D - Cabinets, Racks, Panels, and Associated Equipment
 - 6. TIA/EIA-455 Series - Fiber Optic Test Procedures
 - 7. EIA/TIA 526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - 8. ANSI/ICEA S-83-596-1994 - Fiber Optic Premises Distribution Cable Technical Requirements
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- C. Federal Communications Commission (FCC) part 15 and part 68
- D. The Contractor shall provide the following:
 - 1. All additional material and labor that may be required for compliance with Applicable Code Requirements, even though the work is not mentioned in these particular specifications.
 - 2. Any inspection or examinations required. Copies of certificates of all such inspections shall be delivered to the University's Representative.
 - 3. Refer to General Conditions Article 12.1 for requirements concerning covering of work contrary to requirements.

1.5 QUALIFICATIONS OF INSTALLER

- A. The structured cabling system installation work detailed in this section shall be carried out by a manufacturer certified installer.
- B. The installer shall have a proven track record in the field of telephone and data (category 6 and optical fiber) cabling system installation. The installer shall have completed at least three previous installations of comparable size, complexity and manpower within the last three years. Each installation shall utilize components, installation practices and testing procedure equivalent to those specified in this document and this shall be submitted for University's Representative approval.
- C. The installer shall hold a valid California state contractors license for the duration of the project.

1.6 GENERAL REQUIREMENTS AND CONDITIONS

- A. Quality Assurance
 - 1. The specifications contained herein are set forth as the minimum acceptable requirements of the Contractor's Quality Assurance program. The Contractor is responsible for executing any other Quality Assurance measures necessary to ensure complete and fully functioning systems within the scope of this project.
 - 2. The Contractor shall ensure that all workmanship, materials employed, required equipment, required documentation/certifications of technicians, and the manner and method of installation conforms to accepted industry standard practices. Where specific specifications do not apply, the more stringent of industry publications, manufacturer's guidelines, or previous (similar) work at the project site shall apply.
 - 3. The Contractor shall also ensure that each piece of equipment is in satisfactory working condition.
 - 4. The Contractor shall certify that the cable manufacturers have carried out the quality assurance tests and procedures as specified herein.
 - 5. The Contractor is responsible for ensuring that the cable packaging for shipping/storage purposes meets or exceeds the following requirements:
 - a. One continuous length of cable per shipping reel/container.
 - b. Reels shall be wooden or steel, sturdy, lagged, and shall have thermal protection jackets applied prior to lagging.

- c. Each reel/container shall be individually identified and marked with the length of the cable it contains. Said marking shall withstand weather and shipping conditions and remain readable.
 - d. For fiber optic cable, results of the 100% Attenuation tests conducted at the factory shall accompany each reel.
 - e. Cable shall be packed in a manner that facilitates the pre-installation tests to be conducted while the cable is still on the reel (i.e., both ends of the cable shall be accessible while protected from moisture).
 - f. The Quality Assurance Plan employed shall include on-reel testing of fiber, coax, and UTP, including, but not limited to, OTDR, power loss, attenuation, etc. (as applicable for given cable media).
- B. Manufacturer's Literature: Where these specifications call for an installation to be made in accordance with the manufacturer's recommendations, a copy of such recommendations shall always be kept on the job site and shall be available to campus project staff.
- C. Warranty
 - 1. Furnish to University a written guarantee for a Category 6 Structured Cable System against all defects in materials and workmanship, including failure to transmit data according to TIA/EIA 568B Industry Standard tests for a minimum of 25 years from date of acceptance. Refer to Section 01740, GUARANTEES, WARRANTIES, BONDS, SERVICE & MAINTENANCE CONTRACTS, for submittal form.

1.7 PRODUCT REQUIREMENTS

- A. General Information
 - 1. Refer to Section 01630 - PRODUCT OPTIONS & SUBSTITUTIONS.
 - 2. Where applicable, the most recent manufactured product line consistent with the structured cable system manufacturer identified in the technical specification sections shall be the minimum standard for quality and performance of products to be used on this project.
 - 3. If tests to determine equality and utility are required by the University's Representative, they shall be made by a testing laboratory with the acceptance of the test procedure first given by University's Representative, at the expense of the Contractor.
- B. Quality of Materials
 - 1. All materials and equipment supplied by the Contractor shall be new, manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacturer. All material shall be acceptable to and approved by the University's Representative as meeting these specifications.
 - 2. All communications materials used on this project shall conform, where applicable, to the following specifications, unless otherwise noted:
 - a. NEMA - National Electrical Manufacturers Association.
 - b. ANSI - American National Specifications Institute.
 - c. UL - Underwriters Laboratories, Inc.

- d. The latest IEEE and TIA/EIA 568 specifications.
- 3. Telephone system materials and equipment shall be FCC Type-accepted and certified as such by manufacturer.
- 4. No material employed shall present environmental or toxicological hazards as defined by current industry specifications. All materials shall comply with CAL OSHA and EPA specifications and all other Applicable Code Requirements..
- 5. The equipment, apparatus, and material for fiber optic equipment and apparatus shall conform to existing CAL OSHA health and safety laws. The equipment and apparatus shall have provision for application of safety labels, such as LASER identification, or warning labels as required by system considerations.

1.8 STRUCTURED CABLING SYSTEM

A. Structured Cabling System

- 1. Category 6 AMP NETCONNECT, Berk-Tek/Ortronics or equal.

1.9 SUBMITTALS

- A. Structured Cabling System Pre-Qualification Certificate: The Contractor shall submit a letter of approval from the manufacturer indicating completion of pre-qualification requirements for installation of the Structured Cabling System. Documentation shall include training certificates for installation of the proposed products.
- B. Shop Drawings and Supplemental Data (refer to Section 01340, Shop Drawings, Product Data & Samples and General Conditions Article 3.12)
 - 1. Shop drawings shall be submitted for all communications equipment, cabling, and structure pertaining to the job (i.e. distribution frames, conduit, wire, fiber optic cable, terminations, splices, etc.) as instructed in the various specification sections. Telecommunications product submittals shall be organized in a single bound volume(s).
 - 2. Upon completion of the project two (2) copies of final shop drawings and supplemental data, where called for, shall be submitted to the University's Representative. Two copies of a CD with the AutoCAD files of these drawings shall also be submitted. Final corrected copies of schedules and shop drawings or supplemental data shall be as follows (exceptions shall be noted in Specification Sections):
 - a. Supplemental data shall include information as noted in the specification paragraphs requiring them.
 - b. Shop drawing delineation: the shop drawings shall be drawn to scale and shall be completely dimensioned, giving the plan together with such sections as are necessary to clearly show construction detail.

1.10 RECORD DRAWINGS

- A. Refer to Section 01720, CONTRACTOR'S AS-BUILT DOCUMENTS.
- B. The Contractor shall neatly note floor plans with "as-built" station number and any changes, additions, or deletions to outlet placement. The plans shall also accurately indicate locations of equipment, pull-boxes, sleeves, cable types and labeling of all these items.

- C. The Contractor shall prepare “as-built” plans of all work including riser cable locations. All approved changes and actual in-place footage shall be marked, in red, on a full-size drawing. The as-builts shall include all fiber optic, copper and coaxial riser cables placed with cable lengths, assignments, and cable numbers and counts.

1.11 DEFINITIONS

- A. Backboard: Backboard generally refers to the A-C, fire-retardant, plywood sheeting lining the walls of the telecommunications facilities. Backboards may also refer to the entire wall-mounted assembly, including wire management and termination frames.
- B. Building Entrance Frame (EF) Room: The EF is the location within the building where the outside cables enter the building and are terminated. The riser backbone cables are connected in this room and are distributed to the various IDF’s.
- C. CATV: Cable Antenna Television system.
- D. Cable Plant: Cable, conduit raceways, vaults, junction/pull boxes, rooms, racks, equipment, patch bays/blocks, and other infrastructure required to provide physical, electrical, optical connectivity between buildings on the Campus.
- E. Cable Ladder Rack: Hardware manufactured for horizontal pathway distribution of cable and inside wiring inside telecom rooms.
- F. Cable Tray: Hardware manufactured for horizontal pathway distribution of cable and inside wire from the MDF, BDF, or IDF to the Information Outlet access point.
- G. Copper Entrance Cable: Copper Cable that joins the University's backbone infrastructure at its connecting point to the building’s Entrance Room..
- H. Designation Strips: Paper or plastic strips, usually contained in a clear or color tinted plastic carrier, manufactured for insertion into a termination frame. Designation strips are usually imprinted with the adjacent terminal number and are used to aid in locating a specific pair, group of pairs, or information outlet inserted into the termination frame, or for the purpose of delineating a termination field.
- I. Entrance Conduit: Conduit that connects the University's underground infrastructure with the building's Entrance Room..
- J. Fiber Entrance Cable: Fiber Optic cable that joins the University's backbone infrastructure at its connecting point to the building’s Entrance Room.
- K. Information Outlet: An integral assembly containing terminated Cat 6 cables on RJ-45 jacks and a labeled faceplate.
- L. Inside Plant (ISP): Communications system inside a building (wire, fiber, coaxial cable, equipment and racks, information outlets, etc.).
- M. Intermediate Distribution Frame (IDF): The IDF is the location in a building where a transition between the Riser System and the Horizontal Distribution System occurs. It may include: the physical location, enclosure, wire and cable management hardware, fiber and management hardware, active electronic components, termination hardware, and equipment racks. TIA/EIA-569, "Commercial Building Specifications for Telecommunications Pathways and Spaces" refers to the IDF as the Telecommunications Closet. Throughout this specification IDF and Telecommunications Room are equivalent.
- N. LAN: Local Area Network.
- O. Management Hardware

1. Fiber Management: Hardware manufactured for the purpose of keeping fiber patch cords neat and orderly. Most termination frame manufacturers provide fiber management components made to work in conjunction with their termination frames. Fiber management may also refer to other types of hardware for the purpose of securing fiber optic cable to the building.
 2. Wire Management (Copper, Data, Network): Hardware manufactured for the purpose of keeping cross-connect wire and patch cables neat and orderly. Most termination frame manufacturers provide wire management components made to work in conjunction with their termination frames. Wire management may also refer to other types of hardware for the purpose of securing wire and cable to the building.
- P. Outside Plant (OSP): Communications system outside of the buildings (typically underground conduit and vaults, exterior/underground rated wire and cable, etc.).
- Q. Riser Cable: High volume cable (copper) that connects the BDF with the IDF or backboards located on the same or different floors.
- R. Riser Conduit: Conduit that connects the BDF to the IDF or backboards located on the same or different floors.
- S. Riser Fiber Cable: Fiber Optic Cables that connects the BDF with IDF or backboards located on the same or different floors.
- T. SPOE: Secondary Point of Entry, Utility/Alternate Carrier Partnership in buildings other than the MDF.
- U. Station Wire: Four- pair, unshielded, twisted pair, Category 6 plenum wire that connects the information outlet to the BDF or IDF
- V. Structured Cabling System (SCS): Distribution and wiring system that includes permanently installed horizontal cabling, horizontal pathways, workstation pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for terminating, and interconnecting a complete voice and data network. The SCS shall perform to current TIA/EIA 568B industry standards. On this Project the SCS shall be an AMP NETCONNECT Category 6, or equal system.
- W. Telecommunications Ground: An electrical ground (as defined by local codes), usually the main building ground electrode extended by a continuous 3/0 green insulated copper conductor to grounding buss bars in the MDF, IDF, and roof telecommunications terminal point.
- X. Termination Fields
1. Copper, Data, Network Termination Fields: A group of termination frames clustered together to provide terminations for specific cable or inside wiring groups, where all of the cable or wiring in the group is used for a single purpose, constitutes a copper, data, or network termination field. The extent of a specific field, located in a group of fields, may be distinguished by a physical separation between the frames forming the field, by uniquely colored designation strips, or by a series of terminal numbers.
 2. Fiber Optic Termination Fields: A group of termination frames clustered together to provide terminations for fiber optic cable fibers, where all of the cable fibers are used for a single purpose, constitutes a fiber termination field.
- Y. Termination Frames
1. Copper Termination Frame: Device manufactured for the purpose of terminating large numbers of copper cable or station wire pairs. These devices generally utilize insulation displacement connections and usually require special tools to make the terminations.

Throughout this specification, the terms Copper Termination Frame and Wiring Block are equivalent.

2. Data Termination Frame: Device manufactured for the purpose of terminating copper cable pairs from the active data electronic hardware. These devices generally utilize insulation displacement connections and usually require special tools to make the terminations. Throughout this specification, the terms Data Termination Frame and/or Data Patch Panel are equivalent.
3. Fiber Termination Frame: Device manufactured for the purpose of terminating fiber optic cable fibers into "LC" connector field.
4. Network Termination Frame: Device manufactured for the purpose of terminating copper cable pairs from the active data electronic hardware. These devices generally utilize insulation displacement connections and usually require special tools to make the terminations. Throughout this specification, the terms Network Termination Frame and Network Jack Panel are equivalent.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 16715

TELECOMMUNICATIONS TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Related Sections
- B. Test Plan Submittal Requirements.
- C. General Procedures
- D. Execution of Testing for:
 - 1. Copper Cables
 - 2. Fiber Cables
 - 3. Coaxial Cables
- E. Documentation of Testing Results
- F. Inspection of Grounding Conductors

1.2 RELATED SECTIONS

- A. Section 16710 - Telecommunications General Requirements.
- B. Section 16720 - Telecommunications Basic Materials and Methods.
- C. Section 16725 - Telecommunications Cable.

1.3 TEST PLAN SUBMITTAL REQUIREMENTS

- A. The Contractor shall submit a comprehensive test plan to the University's Representative for all systems installed under this contract for review by the University's Representative. This shall be submitted one (1) month prior to his initiating final testing. This plan may be formatted in a manner convenient to the Contractor, but shall contain as a minimum the following:
 - 1. Itemization of systems to be tested as described in these specifications.
 - 2. Estimated start and completion dates and durations of testing.
 - 3. Staff to be applied and their responsibility, qualifications, certifications and experience.
 - 4. Summary of testing equipment to be used.
- B. The plan shall also include proposed testing configurations, documentation of calibration and proposed calibration procedures, and a list of all measurement equipment to be used.
- C. The staff selected to furnish the testing of this installation shall be certified by the manufacturing company in all aspects of installation and testing of the products described herein, and have a minimum of five (5) years experience on similar SCS cabling systems. The Contractor shall submit to the University Representative the certification of the personnel performing the installation and testing.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES

- A. The Contractor shall furnish all tools, equipment, and fully trained staff necessary to conduct fully witnessed acceptance testing of all installed telecommunications-related products and systems.
- B. The scope of this work includes, but is not limited to, the following:
 - 1. The Contractor shall maintain a check-off list for all tests. This shall be formatted to be used as a tool to apprise the University's Representative of the testing program, its general schedule and accomplishment to-date.
 - 2. The result of the measurements outlined shall be recorded and submitted utilizing the University's furnished format along with current as-built drawings to the University's Representative as final proof of system performance.
 - 3. The Contractor shall immediately replace any system which does not meet industry standards and Manufacturer's published performance specifications at no cost to the University. Failure to act in a timely and expeditious manner to properly remedy any abnormality resulting from installation/construction defects or workmanship; faulty material; and/or the failure of the systems, components, or the cable to perform in accordance with the construction documents and/or the SCS manufacturer's technical specifications shall cause the University's Representative, at its discretion, to place a "hold" on any other telecommunications development or construction associated with this project. The University's Representative will notify the Contractor in writing of such action and is absolved and shall be held harmless from any delays, costs over-runs, scheduling difficulties, etc. assessed by others due to the Contractor's failure to meet the final proof of system performance specifications. Final as-builts shall be furnished, as specified, at the end of the project.
 - 4. All systems shall meet the construction specifications, SCS manufacturer's performance requirements and be accepted by the University's Representative before the work will be considered complete.
- C. After the Contractor has submitted complete documentation of all testing and the documentation have been reviewed by the University's Representative, the Contractor shall conduct "proof of performance" testing, in the presence of University's Representative. These tests shall be conducted on approximately 10% of the installed system capacity. Such testing shall utilize the same equipment and procedures used to conduct and document the initial tests but shall be applied on a random basis to verify the testing documentation. If in the judgment of the University's Representative, the proof-of-performance test results vary significantly from the acceptance test results, the Contractor shall continue with testing beyond the 10% at the discretion of the University's Representative until cleared to the satisfaction of the University's Representative.
- D. Contractor shall have a certified laboratory or the manufacturer shall calibrate all test equipment within the last six months, and such certification shall be submitted to the University's Representative prior to testing.
- E. The University's Representative shall be provided a minimum of one week's notice of all acceptance and proof-of-performance testing to be conducted throughout the project.

3.2 INSPECTION AND TESTING PROCEDURES FOR COPPER CABLE

- A. The University's Representative will conduct routine inspections of the work in progress, and any deficiencies will be discussed at the regular progress meeting. In the event University's Representative determines work is progressing in an incorrect manner and waiting for the regular meeting could cause significant rework by the Contractor, the Contractor's superintendent will be notified.
- B. Copper Station and Riser Cables: The Contractor shall conduct witnessed acceptance testing on all station and riser cable installed as part of this project as defined below:
 - 1. All riser cable pairs shall be tested for crosses, opens, grounds, reversed and/or transposed pairs, shorts, foreign battery, continuity, and resistance (in ohms). All riser cable pairs shall be tested for loss in dB. All problems shall be resolved and the cable re-tested to ensure compliance at Contractor's expense.
 - 2. Using a Category 6 rated pair scanner or similar device, all copper station cables shall be tested to verify the installation complies with the performance requirements of ANSI/TIA/EIA-568-A Category 6. All test results, including jack numbers and cable lengths, shall be printed on a hardcopy report. All stations shall meet or exceed this performance standard.
 - 3. All pair scanners used on the project shall be calibrated to a single common test cable at the start of each shift and after changing batteries. The hardcopy of the calibration results shall be included as a reference with each batch of station test results submitted.
 - 4. Station test results shall be provided in both hard copy and electronic format (floppy disk). Provide a copy of any software that may be required to read and/or print the results.

3.3 INSPECTION AND TESTING PROCEDURES FIBER CABLE

- A. Fiber Optic Riser Cable
 - 1. The appropriate high resolution OTDR device (Fluke DTX 1800 or equal) shall be used to test the fiber riser cable. OTDR testing of riser cables is limited to those with one or more 90 bends and/or a length greater than 80 feet. Ten gigabit testing standards shall be used for the fiber cable.
 - 2. Continuity of all riser fiber optic cables, regardless of length, shall be verified by emitting an intense light source at one end of the fiber and measuring the intensity of light using a power meter at the opposite end of the fiber.
 - 3. Tracing printouts (noting the appropriate optical fiber and buffer tube color designation) shall be mounted on separate pages and bound into a three-ring notebook. An incremental scale that reflects the short lengths of cable involved in these tests shall be utilized.
 - 4. All fiber riser cable shall be tested from the building's EF to each fiber IDF terminal. The results of OTDR testing to define the length of each riser cable shall be documented.
 - 5. The Contractor shall conduct a power meter (loss) test of each fiber optic segment in station and riser cables from patch panel to patch panel. Tests shall be conducted using ANSI/EIA/TIA-526-14A, for Multi-mode and 526-7 for Single-mode. The Contractor shall provide a typed list reflecting cable ID and actual measured loss. ("Testing and Documentation" from the Design Guide 2002 Corning Cable Systems provides an acceptable testing procedure for end-to-end attenuation testing.)

6. Test results shall be provided in both hard copy and electronic format (floppy disk). Provide a copy of any software that may be required to read and/or print the results.

3.4 TESTING PROCEDURE FOR COAXIAL CABLE

- A. All coaxial cable shall be tested after installation for opens, shorts, and kinks with a Time Domain Reflectometer (TDR). Damaged sections shall be replaced either by pulling a new line or by splicing out the defective portion. The actual length of each cable section, as installed, shall be indicated on the Record Document plans.

3.5 DOCUMENTATION OF TESTING RESULTS

A. Fiber Cable Systems

1. All documentation shall be neatly and legibly done and shall provide a clear understanding of the installed system.
2. The Contractor shall furnish signed originals of all testing documents in a three ring binder, which are:
 - a. Fiber optic insertion loss results
 - b. OTDR graphs and printouts and test results
 - c. Current test equipment certifications

B. Copper Cable Systems

1. The Contractor shall use forms furnished by the University or Structured Cabling System manufacturer if approved by the University's Representative, to document the successful testing of all inter-building, entrance, riser and tie cables.
2. Test equipment used shall be the Fluke DTX-1800 Cable Analyzer, or equal, with the appropriate module for Category 6 testing or fiber cable testing.
3. Category 6 station cable test results noting unique station number and group test results by floor shall be furnished.

3.6 INSPECTION AND TESTING PROCEDURES FOR TELECOMMUNICATIONS GROUNDING SYSTEM

- A. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.
- B. Testing of Bus Bar backbone grounding installed by others will be completed by others also.

END OF SECTION

SECTION 16720

TELECOMMUNICATIONS BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers and Cable Ties.
- B. Conduits
- C. Conduit Supports
- D. Cable Tray (Flex-Type)
- E. Ladder Racks
- F. Fiber Optics Terminals
- G. Cable Tags and Labels
- H. Outlet Labels
- I. Outlets
- J. Face Plates
- K. Patch Panels
- L. Equipment Racks
- M. Wire Managers
- N. Analog Line Terminations
- O. ReadySleeve Kits, or equal

1.2 RELATED SECTIONS

- A. Section 16710 - Telecommunications General Requirements.
- B. Section 16715 - Telecommunications Testing.
- C. Section 16725 - Telecommunications Cable.

1.3 APPLICABLE PUBLICATIONS

- A. As defined in Section 16710 - Telecommunications General Requirements.

1.4 SUBMITTALS

- A. Product cut sheets data with sizes to be used for:
 - 1. Hangers and Cable Ties
 - 2. Ladder racking.

3. Fiber optic patch/termination panels, frames, enclosures, and hardware.
4. Cable Tags
5. Outlet Labels
6. Outlet components including faceplates (Also submit sample drawings of each type of outlet with labels.)
7. Patch Panels
8. Equipment Racks
9. Wire Managers.
10. Copper terminals and hardware.
11. ReadySleeve Kits, or equal
12. Contractor shall provide cut sheets outlining the type of fire-stop material used in each type of construction and the firestop assembly selections that comply with UL Fire Resistance Directory. Cut sheets shall be reviewed and approved prior to installation.
13. Faceplate Mock-Ups: Prior to terminating cabling at new faceplate locations Contractor shall provide a mock-up of a fully configured cable faceplate, including jacks, connectors and labeling per the Contract Documents. Upon review and approval by University's Representative, this mock-up will be used as the standard throughout the Project.

PART 2 - MATERIALS

The Contractor shall install materials and equipment as part of a Structured Cabling System (SCS). The various sections of this specification pertain to specific products and/or installation requirements that shall conform to the warranty requirements of the proposed Structured Cabling System manufacturer.

2.1 HANGERS AND CABLE TIES

- A. Materials: All hangers and cable velcro ties shall be designed to support communications cable (including the fiber) without kinking or damage. Horizontal cable supporting hardware shall be UL Listed. The J-hook(s) shall provide a broad base for proper cable support, thereby reducing stress and bending of cabling. Contractor shall utilize the sufficient number of J-hooks per Manufacturer's recommended cable capacities for the number of cables to be installed, plus the greater of 30% spare j-hooks or one spare j-hook per location.
 1. Hangers shall be metal construction and shall provide a cable support hanger in a "J" configuration designed to support multiple communications cables. (ERICO Caddy part # CAT32AFAB3 or equal for 2". Use same type for larger sizes as needed.)
 2. No more than twelve (12) station cables may be supported by a single hanger without using a saddle (3 inches wide at a minimum) to support the weight of the additional cables. (Caddy part # CAT425WM, CAT425, or equal.)
 3. Larger types of wire hangers (larger J-hooks or Tri-hooks) are acceptable for locations requiring more than twelve cables. Copper and fiber cables shall be properly installed per the manufacturer's specifications to insure maximum cable performance.
 4. Velcro ties used within a rated ceiling plenum space shall be rated low smoke and shall be certified for use in a plenum environment.

2.2 CONDUIT – ELECTRICAL METALLIC TUBING (EMT)

- A. EMT conduit shall comply with Underwriter's Laboratories UL 797, ANSI C80.3 and Federal Specification WW-C-563 or latest revision. EMT shall be galvanized or sheardized.
- B. Couplings and connectors for EMT shall be galvanized or cadmium plated and shall be of the compression type requiring the tightening of a nut on a gland ring. No die cast type shall be allowed. All connections shall have permanent insulated throats. Manufacturer: Appleton, Crouse-Hinds or equal.

2.3 CONDUIT SUPPORTS

- A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be interlocked with the suspension rod socket.
- B. Pipe racks for a group of parallel conduits shall be galvanized structural steel preformed channels of length as required, suspended on threaded rods and secured thereto with nuts above and below the cross bar. All offsets shall be in the same plane and shall be parallel.
- C. Factory made pipe straps shall be one-hole malleable iron or two-hole galvanized clamps.
- D. Manufacturer: Kindorf, Unistrut, T&B or equal.

2.4 CABLE TRAY (FLEX-TYPE)

- A. Materials
 - 1. The cable trays shall be twelve inches (12") wide by a minimum of 4" deep unless otherwise noted in the drawings.
 - 2. The tray shall be welded steel mesh. It is to be equipped with a solid bottom only where specified in the MEC Drawings.
 - 3. The tray shall be equipped with elbows, tees, and other attachments as required to complete the installation following manufacturer's guidelines.
 - 4. Each end of the tray shall be equipped with a finished lip and drop off to reduce damage to cables.
 - 5. The tray shall be supported no less than every six feet. Support attachments shall be made only to the building structure.
 - 6. The cable trays shall be NEMA Class Designation 12B (75 lbs per linear foot). Trays shall qualify under CEC Section 318-7(b) as equipment grounding conductor.
- B. Manufacturer: GS Metals Flextray, B-Line, Wiremold, or equal.

2.5 LADDER RACKING

- A. Materials
 - 1. Cable support ladder racks shall be installed as defined in the Contract Documents and in any location where additional pathways are required to support large numbers of station cables that are otherwise not supported.
 - 2. The racks shall be either twelve, eighteen, or twenty-four inches wide as shown on the drawings.

3. The racks shall be classified by Underwriters Laboratories (UL) as suitable for equipment grounding.
4. The racks shall be earthquake braced for zone 4. The Contractor shall provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
5. Telecom Rooms shall have steel tubular style ladder racking, factory painted black.

B. Manufacturer: Chatsworth part # 11275-X12-7, or equal.

2.6 FIBER OPTIC TERMINAL PANELS

A. Materials

1. The connector housing shall be rack-mountable on a 19-inch wide equipment rack.
2. The terminal panel shall provide cross-connect, inter-connect, and splicing capabilities and contain the proper troughs for supporting and routing the fiber cables/jumpers.
3. The terminal panel shall consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of fibers.
4. The terminal panel shall have a "window" section to insert connector panels for mounting of connectorized fibers (LC style couplers and connectors).
5. The terminal panel shall provide terminating capability of couplers, in the quantity noted on the contract drawings, in panels of 6 or 12 respectively.
6. The Contractor shall install LC style couplers in all patch bays that meet or exceed the following specifications:
 - a. Operating Temperature: -40° to 140°F (-40° to 60°C).
 - b. Average Loss: 0.3 dB.
7. Fiber optic connectors shall be Corning, or equal. Connector specifications shall be as follows:

a. attenuation	< 0.2 dB @ 1300 nm typical.
b. reflection	<-25 dB typical.
c. connector durability	<0.2 dB change after 500 matings.
d. ferrule	zirconia ceramic.
e. housing	nickel plated zinc.
f. boot	Estane.
8. A common panel shall be used to terminate singlemode and multimode optical fibers.

B. Manufacturer: Berk-Tek, Corning or equal.

2.7 CABLE TAGS AND SPLICE CASE LABELS

A. Materials:

1. Metal or heavy plastic identification tags with cable type and number, copper pair or optic number assignments, and destination shall be provided on both ends of all cables (except station cables) and all splice cases.

2. All cables shall be clearly labeled with cable number, cable counts, cable type, and cable size at each end of the cable, when it enters or leaves a conduit and at 30-foot intervals when run in accessible areas such as tunnels, manholes, ceilings, etc. Cable tags shall indicate the cable information as shown on the inter-building and riser drawings for copper and fiber cables.

B. Manufacturer: Berk-Tek/Ortronics Labeling, or equal.

2.8 OUTLET LABELS

A. Materials:

1. All labels shall be made using a label maker that produces clear adhesive labels with black typeset characters. The labels shall have a strong adhesive that shall not come off unless it is forced off. The label size shall be 3/16 inch wide with a typeset font no smaller than 10 point. The Contractor shall utilize the label maker and labels that are recommended for the selected Structured Cabling System. The standard faceplate is a 6-port plate.
2. The Contractor shall submit a sample label to the University's Representative for approval prior to labeling the new outlets.
3. The labels on each faceplate shall contain the following information:
 - a. On the top label window: The number 4334, dash, Telecom Room number (e.g. 1.1, 1.2, 3.2), dash, room number of the outlet on the first line. On the second line in the top window, note the first row of jacks, e.g. V1, V2.
 - b. On the bottom label window: note the second row of jacks, e.g. D1, D2. On the second row of the window, note the third row of jacks, if any.
 - c. Voice/ Data Outlets (3 or 5 cables)

Port 1:	1V (For VoIP cable).
Port 2:	1A (For data cable).
Port 3:	1B (For data cable).
Port 4:	1C (For data cable) (if required).
Port 5:	1D (For data cable) (if required).
 - d. Data Only Outlets (1 to 8 cables)

Port 1:	1A (For first data cable).
Port 2:	1B (For second data cable).
Etc.	
 - e. Wireless Application Data Outlet (Two cables)

Port 1:	1A (for first data cable)
Port 2:	1B (For second data cable)

Use 2-port stainless steel faceplate.
 - f. Voice Wall Outlet (One cable)

Port 1:	1V (For first voice analog line)
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Use single port stainless steel faceplate.
 - g. The numbering for voice cables shall be consecutive and sequential for each telecom room. For example, V1, V2, V3, etc. until all voice cables are numbered in that telecom room serving area.
 - h. The numbering for data cables shall be consecutive and sequential in each room. For example, 1A, 1B for the first outlet, 2A, 2B for the second outlet in that room. As the rest of the data outlets are numbered keep a consecutive and sequential

order until all data outlets for that telecom room area are labeled. For example, in a second room the designation would be 3A and 3B, in the next room it would be 4A and 4B, etc.

- i. Prior to starting the labeling on the outlets, discuss the planned method with the University's Representative to be sure this is still the desired labeling.

2.9 STATION OUTLETS

NOTE: The University color coding standard for Category 6 four-pair cabling is blue.

- A. Colored Icon to be used on the individual jacks: For VoIP – Yellow; For Analog – White; For Data – Blue; and, for Wireless jacks – Green. All Category 6 jacks to be Fog White in color.
- B. Voice/Data Outlets
 1. The standard voice/data outlet shall consist of three (3) and/or five (5) Category 6 four-pair cables, each terminated on a separate Category 6 rated RJ45 8-position jack following EIA/TIA T568B wiring standards. One jack shall be for Voice over IP, remaining jacks designated for data.
 2. The modular jacks shall be rated for Category 6 performance in the configuration installed. Manufacturer: Berk-Tek/Ortronics or equal.
 3. The faceplate shall be clearly labeled with outlet number, and each jack shall be labeled with jack number. All labels shall be typed or preprinted and shall be securely affixed to the faceplate.
 4. Blank inserts shall be placed in the vacant slots.
 5. Manufacturer: Berk-Tek/Ortronics Structured Cabling System or equal.
- B. Data Only Outlets
 1. The data only outlets shall consist of Category 6 four-pair cables, each terminated on a separate Category 6 rated RJ45 8-position jack and blank inserts in a white quad outlet faceplate. The number of terminated cables at each outlet shall be according to floor plan drawings. Jacks shall be fog white in color.
 2. One to eight Category 6 copper station cables shall terminate on white jacks that shall be rated for Category 6 performance in the configuration installed.
 3. The faceplate shall be clearly labeled with outlet number, and each jack shall be labeled with jack number. All labels shall be typed or preprinted and shall be securely affixed to the faceplate.
 4. Blank inserts shall be placed in the vacant slots.
- C. Voice Only Outlets
 1. Voice only outlets shall consist of a single four-pair Category 6 cable connected to Category 6 rated RJ45 8-position jack assembly with a metal cover plate suitable for securing a wall mounted telephone.
 2. All wall phone outlets shall be placed at 44 inches above the finished floor unless otherwise noted to make the maximum height to the top of the telephone 48 inches above the finished floor.

3. Wall phone outlets shall be equipped with a duplex mud-ring around the standard dual gang outlet box recessed in the wall where possible.
4. Wall phone outlets shall consist of a stainless steel, one-port, faceplate equipped with a single RJ-45 modular jack.
5. Manufacturer: Berk-Tek/Ortronics Structured Cabling System or equal.

D. Wireless Application Outlet

1. The outlet for connections of wireless devices shall be two Category 6 four-pair cables, each terminated on a separate Category 6 rated RJ45 8-position jack.
2. The wireless application outlet shall consist of a 2-port stainless steel faceplate.
3. Manufacturer: Berk-Tek/Ortronics Structured Cabling System or equal.

E. Floor-Mount Outlets

1. The voice/data floor-mount outlet shall consist of three (3) and/or five (5) Category 6 four-pair cables, each terminated on a separate Category 6 rated RJ45 8-position jack following EIA/TIA T568B wiring standards. One jack shall be for Voice over IP, remaining jacks designated for data.
2. The communications portion of the outlet shall be equipped with a NEMA standard duplex faceplate cutout and four RJ45 jacks.
3. Manufacturer: Berk-Tek/Ortronics Structured Cabling System or equal.

2.10 FACEPLATES

- A. Provide faceplates for every information outlet (voice, data, and network) unless otherwise noted. They shall meet the required NEMA standard.
- B. All faceplates shall be available in six plex arrangement in a single gang configuration and furnish blank inserts where needed.
- C. Surface mount boxes shall be available in a six plex configuration.
- D. Wireless Application Outlet and Voice Wall Outlet faceplates shall be two-port and one-port stainless steel, respectively.

2.11 48-PORT ANGLED PATCH PANELS

A. Materials

1. All copper station cable terminations shall be made on Category 6, 48-port Angled SL Series Patch Panels. All cables shall be terminated on patch panels in the equipment racks. The different types of circuits such as VoIP and Data should not be separated into patch panels.
2. Separate analog voice lines patch panels shall be provided in addition to the station cable patch panels on the racks. These shall be connected directly to the Service Provider's lines with a tie cable. Connection of these shall be specified below.
3. All patch panel assemblies shall include wire retention clips as specified by the Structured Cabling System manufacturer.

4. Horizontal managers shall be used after every four patch panels (See rack elevations in the drawings).

B. Manufacturer: Berk-Tek/Ortronics or equal.

2.12 MDF/ IDF EQUIPMENT RACKS

A. Materials

1. Each MDF/IDF shall be equipped with 8' high, 23 1/2" wide by 16 1/2" deep equipment racks (Ortronics Mighty Mo 10, or equal) for fiber optic terminations, data equipment and patch panels including future growth. See the specific room layout plan for the number of racks.
2. The frame shall be a bolted steel construction and shall meet ANSI/EIA-310-D standards for equipment support frames. Seismic cross bracing shall be provided.
3. Floor-mounted frames shall have a self-supporting base designed to be anchored to the floor.
4. Frames shall be factory painted black.

B. Manufacturer: Ortronics Mighty Mo 10 (OR-MM10816) or equal.

2.13 WIRE MANAGEMENT

A. Materials

1. All equipment and fiber optic panel frame racks shall be equipped with vertical wire management organizers as outlined in the design documents.
2. All wire managers shall be heavy duty painted metal units designed specifically to connect to equipment frames.
3. All wire managers shall be secured to the frames and shall provide a clear and unobstructed pathway in which to route the cables.

B. Vertical Wire Managers

1. Vertical wire managers shall be 8' high and ten inches wide and shall have a minimum of seven evenly spaced wire rings designed to maintain jumper, patch, or cross-connect wire in place.
2. These organizers shall be designed to extend past the frame to allow placement of equipment in any position within the rack. When mounted between equipment frames, they shall be designed to direct cables into either frame and shall be securely mounted to both units.
3. Manufacturer: Ortronics OR-MM6VM810 (10") or equal.

C. Horizontal (Mounted at the top rack units) Wire Managers

1. The in-frame horizontal managers shall be two rack units in size and shall extend from side rail to side rail. These units shall be equipped with a minimum of four horizontal supporting rings and a minimum of eight smaller retaining rings top and bottom to route cables directly into equipment ports. The horizontal retaining rings shall be a minimum of 3" by 3".
2. Manufacturer: Ortronics or equal.

2.14 ANALOG LINE TERMINATIONS

- A. The riser cables shall be terminated on BIX terminations placed on the wall. Two 50-pair BIX Mounts shall be placed on the wall of each telecommunications room for termination of the riser cable. Eight 50-pair BIX Mounts shall be for a 200-pair tie cable from the BIX Mounts to the separate analog panels. University personnel shall make cross-connects between the two sets of BIX Blocks on the wall to activate analog lines.
- B. Two separate 48-port patch panels, 2 RMU high, shall be specially placed on a rack for an analog cable between the BIX mounts and the patch panels.
- C. The Contractor shall place a 200-pair riser-rated copper cable terminated at the BIX Blocks at the wall and on the back of the separate Analog Patch Panels in the racks.
- D. Manufacturer 48-port patch panel: Ortronics Structured Cabling System or equal. BIX terminating mounts and connectors Belden (part numbers A0284798 and A0393146, respectively), or equal.
- E. Manufacturer: BIX terminating mounts and connectors Belden (part numbers A0284798 and A0393146, respectively), or equal.

2.15 READY SLEEVE FIRE STOPPING KITS

- A. Materials
 - 1. The fire rated pathway devices shall have a UL classification marking.
 - 2. The fire rated pathway devices shall be tested in accordance with ATSM E 814 (ANSI/UL 1479).
 - 3. Cables passing through fire-rated floors or walls shall pass through fire rated pathway devices that contain an intumescent inert material that automatically adjusts to any cable addition or removal.
 - 4. The fire rated pathway devices shall have an F rating equal to the rating of the barrier in which the device is installed.
 - 5. The fire rated pathway devices shall be capable of allowing 0 to 100-percent visual fill of cables.
 - 6. The fire rated pathway devices shall be sized to accommodate the quantity of the cables used. See drawings for specific sizes.
 - 7. The fire rated pathway devices shall be 1", 2" or 4" depending on the needs.
- B. Manufacturers: Specified Technologies Inc., Unique Fire Stop Products, Inc., or equal.

2.16 FIRE STOPPING

- A. Contractor shall furnish and apply fire stopping material around all cables in any current conduits that are used for pathways on this project.
- B. Materials
 - 1. The fire rated pathway assembly shall have a UL classification.
 - 2. The fire rated pathway shall have an F rating equal to the rating of the barrier in which the pathway is installed.

3. Fill material shall be an intumescent inert sealant that complies with the assembly rating.

C Manufacturers: Specified Technologies Inc., Unique Fire Stop Products, Inc., or equal

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. All installation work shall be performed according to published industry guidelines, rules, and regulations. All Structured Cabling System products shall be installed according to manufacturer procedures.
- B. All pathways shall avoid electromagnetic interference (EMI). Cable that is distributed in partially-enclosed metallic pathways shall be routed with the following minimum clearances:
 1. Four (4) feet from motors or transformers.
 2. One (1) foot from conduit and cables used for electrical power and distribution.
 3. Five (5) inches from fluorescent lighting.

3.2 HANGERS AND CABLE TIES

- A. In suspended ceiling and raised floor areas where walker duct, cable trays, or conduit are not available, station wiring shall be bundled with velcro or plastic cable ties at 5 foot intervals or less.
- B. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- C. Hangers supporting the cable bundling shall be attached to the existing building structure and framework.
- D. Hangers shall be installed to provide at least 3 inches of clear vertical space between the cable bundling and the ceiling tiles.

3.3 CONDUIT

- A. All conduit shall be routed parallel and perpendicular to walls.
- B. All conduit shall be installed in accordance with NEMA "Standard of Installation" and shall meet applicable local and national building and electrical codes or regulations.
- C. New station cable conduit runs shall not exceed 100 feet (horizontal plus vertical distances) or contain more than two 90 degree bends without utilizing appropriately sized pull boxes
- D. No communications outlet boxes shall be "daisy-chained."
- E. In rooms with a drop or false ceiling, and communications outlets shall be served by conduit, the conduit shall stubbed six inches above the false ceiling, angled toward the cable tray or open access area, and shall be equipped with a compression fitting and plastic bushing. All stubs shall be marked "Comm."
- F. All conduit shall be equipped with an approved water or barrier seal in building access points.
- G. All conduits entering a building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room.
- H. All conduits leaving the entrance room for other portions of the building will be fire-stopped after the installation of cable.

- I. All conduits are to be concealed unless installed in exposed ceiling areas as indicated on the drawings. No conduits shall be left exposed in public areas.

3.4 CONDUIT SUPPORTS

- A. Securely fasten all conduit to walls and support using clamps and clips designed for the purpose.

3.5 CABLE TRAY (FLEX-TYPE)

- A. Cable trays shall be installed in accordance with NEMA VE 1.
- B. The Contractor will be responsible for placement of the cable tray in concert with other trades, allowing sufficient room for the cable installers to gain access to all portions of the tray system. Cable tray location shall be coordinated with open ceiling areas, access panel locations, and feeder conduit positions to provide an accessible cable pathway throughout the facility.
- C. All metallic trays must be grounded and may be used as a ground conductor. Trays used as an equipment grounding conductor must be clearly marked. Use # 6 AWG conductors to connect portions of cable tray in order to maintain continuity throughout the total length of the tray.
- D. Trays shall be bonded end-to-end.
- E. When cable trays enter distribution rooms, they should enter six inches into the room, then utilize a drop out to protect station cables from potential damage from the end of the tray.
- F. Cable trays shall be placed a minimum of six (6) inches from any overhead light fixture and twelve (12) inches from any electrical ballast. A minimum of eight (8) inches of clearance above the tray shall be maintained at all times. All bends and T-joints in the tray shall be fully accessible from above (within 1 foot). Trays shall be mounted no higher than twelve (12) feet above the finished floor and shall not extend more than eight (8) feet over a fixed ceiling area.
- G. A separate conduit sleeve (minimum of two inches) must be provided as a pathway through any wall or over any obstruction (such as a rated hallway) from the cable tray into any room having a communications outlet.
- H. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after installation of cable.
- I. In rooms without a drop ceiling (open to the structure), the cable shall be mounted as high as possible to provide the greatest clearance above the finished floor.

3.6 LADDER RACKING

- A. Ladder racking shall be placed so that fully loaded racking shall not obstruct or impede the operation of lighting, air handling systems, and fire extinguishing systems.

3.7 FIBER OPTIC TERMINAL PANELS

- A. Final location of frames shall be coordinated with the University's Representative.
- B. Rack-mounted fiber panels shall be mounted at the top of the rack.
- C. All cables mounted into fiber optic panels shall be installed and secured as defined by the manufacturer using the tools, materials, and techniques outlined by the manufacturer.

3.8 CABLE TAGS AND LABELING

- A. The Contractor shall legibly label all voice and data outlets, cable, blocks, frames, and patch panels as approved by University's Representative and as defined herein. Outlet faceplates shall be labeled on both sides.
- B. The Contractor shall employ a cable labeling and tagging scheme that meets ANSI-606 specifications.
- C. Construction labels shall be installed on all cables as they are pulled. These labels shall contain the same information as the finished labels. Typed labels on self-sealing tape shall be used. Each cable shall have a unique number that shall be related to the appropriate faceplate number and jack letter.
- D. A label shall be installed on each conduit attached to a communications wall box and shall be affixed to the end of the conduit near the cable tray. The label shall have a unique number related to the appropriate faceplate number and jack letter.
- E. Labels shall be installed on all station cables within two (2) inches of the end of the outer jacket material within the back box and at the blocks/patch panel. Typed labels on self-sealing tape, with a plastic overlay, shall be used. Each cable shall have a unique number that shall be related to the appropriate faceplate number and jack letter.
- F. Labels shall be installed on all patch panels, blocks, and both the inside and outside of all faceplates. A uniquely numbered label for each faceplate and a unique letter for each jack shall be supplied and installed. The labels shall be machine printed (not embossed) on vinyl tape using a Brothers label maker or equal. The labels shall have protective overlays.
- G. Labels shall be numbered according to a scheme developed in consultation with the University's Representative.
- H. Ground Bars
 - 1. The master ground bar shall be labeled as such.
 - 2. Each subsidiary ground bar shall be labeled as such and have a unique identifier.
 - 3. All ground bars shall have a warning label that states, *"If this connector or cable is loose or shall be removed, please call the Telecommunications Manager."* All ground bars shall be connected to the building ground with continuous "0" AWG wire.
 - 4. Each ground cable shall be labeled with a unique identifier.

3.9 STATION OUTLETS

- A. Station outlets shall be mounted securely at work area locations.
- B. Station outlets shall be located so that the cable required to reach the desktop equipment is no more than 16 feet long.
- C. Station outlets should not be "daisy-chained."

3.10 FACEPLATES

- A. The voice/data faceplates shall have their jack positions labeled. The first voice line is the VoIP line; the second and third positions are data lines.
- B. The Contractor shall verify labeling scheme with University's Representative before starting the labeling to assure no changes have been made by the University.

3.11 PATCH PANELS

- A. Mount 48-port Angled Patch Panels on equipment racks.
- B. Label each patch panel as per scheme furnished by University's Representative.

3.12 EQUIPMENT RACKS

- A. Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by Applicable Code Requirements.
- B. All racks shall be grounded to the telecommunications ground bus bar in accordance with TIA/EIA 607.
- C. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

3.13 WIRE MANAGERS

- A. Provide side-mounted vertical cable management with covers on both sides of each rack. The cable management shall be with cover plates and bracket kits as needed to attach to adjacent racks.

3.14 ANALOG LINE TERMINALS

- A. BIX mount assemblies shall be mounted on the wall as per Construction Drawings.

3.15 READYSLEEVE KITS OR EQUAL

- A. No support struts and clamps required.
- B. Fire stop putty provided with kit.
- C. Installation instructions with kits.

3.16 FIRESTOPPING

- A. Contractor is responsible for furnishing and placing fire stopping around cables placed in any of the conduits provided by others as well as for the new penetrations required for the cabling on this project.
- B. Conduits placed by others and left vacant on this project are not the responsibility of the Contractor.

END OF SECTION

SECTION 16725

TELECOMMUNICATIONS CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Copper Riser Cable.
- B. Copper Station Cable.
- C. Fiber Optic Riser Cable.

1.2 RELATED SECTIONS

- A. Section 16710 - Telecommunications General Requirements.
- B. Section 16715 – Telecommunications Testing.
- C. Section 16720 – Telecommunications Basic Materials and Methods.

1.3 APPLICABLE PUBLICATIONS

- A. As defined in Section 16710 - Telecommunications General Requirements.

1.4 SUBMITTALS

- A. Product data, including both product construction and performance specifications, for each type and configuration of cable to be supplied. In addition, the Contractor shall provide product data and installation instructions for all fire stopping materials.
- B. Proof of Telecommunications Structured Cabling System certification.
- C. Copies of signed optical cable reel tests.

PART 2 - MATERIALS

The Contractor shall install cables and equipment as part of a Structured Cabling System (SCS). The various sections of this specification pertain to specific products and/or installation requirements that shall conform to the warranty requirements of the proposed Structured Cabling System manufacturer.

2.1 COPPER RISER CABLE

- A. Material
 - 1. Application: Use for placement in vertical risers in buildings and in general horizontal applications within buildings.
 - 2. Compliance: Bellcore Specification TS-TSY-000111, UL Listed Type MPR/CMR
 - 3. Core Construction
 - a. Conductors: Solid-copper conductors, 24 AWG.

- b. Insulation: Dual insulation consisting of an inner layer of foamed polyolefin surrounded by a solid PVC skin, color coded in accordance with telephone industry standards.
 - c. Twisted Pairs: Insulated conductors twisted into pairs with varying lay lengths to minimize crosstalk.
 - d. Core Assembly: Cable cores made up of 100 pair super-units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders. Each 25 pair-unit within the 100 pair super-unit identified with a different binder color. (Note: "PIC MIRROR IMAGE" multi-unit identification used in cables over 900 pairs.)
 - e. Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
 - 4. Alvyn Sheath
 - a. Aluminum Shield: Corrugated, adhesive coated, 0.008" aluminum tape applied longitudinally with an overlap.
 - b. Jacket: Gray, flame retardant PVC jacket bonded to the coated aluminum.
 - 5. Cable sizes defined in Contract Documents.
 - B. Manufacturer: Berk-Tek, General Cable (ARMM, part number depends on size) or equal.
- 2.2 COPPER STATION CABLE (CATEGORY 6, PLENUM)
 - A. Material
 - 1. Use for voice and data applications to interconnect services from workstation to the wiring closet in a plenum or non-plenum rated space.
 - B. CMP rated only.
 - 1. Four pair, 23 AWG, Category 6, UTP, as defined by the EIA/TIA standards intended for use with transmission rates up to and including 250 Mbps. Cabling shall be AMP Cat 6 or equal tested up to 500 MHz. The sheath color of the cable shall be blue.
 - C. Manufacturer: Berk-Tek LANMARK 2000 or equal.
- 2.3 ARMORED SINGLE-MODE FIBER OPTIC RISER CABLE
 - A. Materials
 - 1. Application: Use for placement in vertical riser backbone within buildings.
 - 2. Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.
 - 3. Characteristics - Cable
 - a. OFNR/FT4 rated for riser applications
 - b. Dielectric strength member
 - c. Tight buffer design

- d. Minimum pulling tension of 600 lbs.
- 4. Characteristics – Single-mode
 - a. 8.3/125/250 μm (core/cladding/protective coating) dual window (1310 and 1550 nanometers)
 - b. Maximum attenuation: .4 dB/km @ 1310 nm and .3 dB/km @ 1550 nm
 - c. Zero dispersion slope (1300 - 1322 nm): -0.095/(nm²/km)
- B. Manufacturer: Corning, or equal.

2.4 ARMORED MULTI-MODE FIBER OPTIC RISER CABLE

- A. Materials
 - 1. Application: Use for placement in vertical riser backbone within buildings.
 - 2. Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.
 - 3. Characteristics – Cable.
 - a. OFNR/FT4 rated for riser applications
 - b. Dielectric strength member
 - c. Tight buffer design
 - d. Minimum pulling tension of 600 lbs.
 - 4. Characteristics – Multimode.
 - a. 50/125 μm (core/cladding) dual window (850 and 1300 nanometers), laser optimized
 - b. Maximum attenuation: 3.4 dB/km @ 850 nm and 1.0 dB/km @ 1300 nm
 - c. Minimum bandwidth: 200 MHz•km @ 850 and 500 MHz•km @ 1300 nm
 - d. 0.275 numerical aperture
- B. Manufacturer: Corning, or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. All installation work shall be performed according to published industry guidelines, rules, and regulations. If disputes occur, local, state, and national codes have precedence; then standards such as EIA/TIA; then guidelines from firms such as Building Industry Consulting Services International (BICSI), Berk-Tek/Ortronics Structured Cable System Installation Requirements; then specific component manufacturer's recommendations.
- B. The Contractor shall furnish sufficient trained staff to monitor all work undertaken and ensure that the requirements of these specifications are met throughout the installation process.

- C. All installation work shall be of the highest quality. The Contractor shall at all times make every effort to conduct all installation work in a manner so as to minimize the impact on the facilities. Whenever possible, all work shall be hidden behind finished materials and all surfaces shall be returned to their original condition.
- D. The Contractor shall provide all pathway and cable support hardware necessary to successfully complete the installation. This includes, but is not limited to, hangers, ladder racks, support brackets, sleeves, fire stop materials, tie-wraps, and access openings such as core drills. Conduit pathways have been provided by others.
- E. The Contractor shall ensure that only staff fully qualified to work on specific types of materials are allowed to undertake the required installation. Particularly, copper and fiber optic cable placement, termination, splicing, and testing shall only be undertaken by staff certified by the Structured Cabling System cable or fiber cable manufacturers.
- F. The Contractor shall provide all hardware, software, and miscellaneous components necessary to provide a complete system.

3.2 COPPER RISER CABLE

- A. All riser cables shall be installed in a neat and orderly manner that provides the maximum amount of room for future cable additions. All riser conduits shall be pulled as full as possible. All cables shall be supported on each floor using at least three straps (not more than 30 inches apart) per floor. Riser cable shields shall be grounded on any floor in which pairs enter or leave the sheath. All shields shall be bonded end-to-end.
- B. All riser conduits shall be sealed using a UL classified firestopping system. The Contractor shall provide a copy of the fire seal manufacturer's installation instructions and rating information prior to inspection of the installed materials.

3.3 COPPER STATION CABLE

- A. All station cables shall be neatly dressed, secured, and concealed throughout the installation. Cables shall be secured with plastic ties to a snug fit but shall not deform the cable geometry. Ties shall be of a plenum-rated material if cable is installed within a plenum ceiling space.
- B. All station cables shall be secured a minimum of twelve (12) inches above the ceiling T-bar grid. Ceiling grid supports, electrical conduit, water pipes, and HVAC ducting may not be used to support cables. No more than 12 individual cables shall be secured to a single ceiling hanger without the use of a two-inch wide saddle to eliminate strain on individual cables. Cables shall not be placed within 24 inches of overhead lights or any other potential source of electrical interference.
- C. In any area in which a fire-rated wall, partition, floor, or ceiling is penetrated, the Contractor shall be responsible for creating the pathway and sealing around all cables and sleeves with a UL classified fire seal sufficient to return the structure to its original rating. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any opening in a rated structure created by the Contractor that is larger than one inch in diameter shall be equipped with a metal sleeve secured and fire-stopped in place.
- D. All station cables shall be placed with a 1 meter maintenance loop (slack cable) neatly coiled and secured in the ceiling space above the outlet to allow for future rearrangement.
- E. The Contractor is responsible for removing, replacing, and repairing ceiling tiles in order to route all cables. Concealed spline ceiling tiles shall not be replaced until installation work in that area

has been inspected and reviewed with campus personnel and approval given to re-fix the ceiling in place.

- F. All station cables shall be terminated on rack-mounted patch panels that are designated specifically for data, VoIP and analog, and shall be clearly marked with a unique identification number following the campus standard. Equipment rack elevations on the drawings show where the various patch panels are to be located.

3.4 FIBER OPTIC RISER CABLE

- A. The fiber riser cables, as defined in the drawings, shall be continuous (no splices) end-to-end.
- B. A total of twenty-five feet of slack (in each closet) shall be provided for each cable, and the slack shall be coiled and secured to the backboard.
- C. All cables (and panels) shall be clearly identified at both ends with a unique cable/optic numbering system. The number system shall be coordinated with the University's Representative.
- D. All cables shall be installed using the manufacturer's procedures, tools, and equipment and shall be protected from physical damage. All fiber cables shall be installed so as to protect the optical fibers and connectors from strain and physical damage. The minimum bending radius shall not be exceeded during cable placement.
- E. All riser cables shall be supported with strain relief on each floor. All fiber optic cables to be armored with no inner duct.

END OF SECTION

SECTION 16760

TELECOMMUNICATIONS GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Applicable Publications
- C. Work Sequencing and Coordination
- D. Telecommunications Submittals
- E. Quality Assurance
- F. Project Record Documents
- G. Qualifications
- H. Regulatory Requirements
- I. Performance Requirements
- J. Materials
- K. Execution

1.2 APPLICABLE PUBLICATIONS

- A. American National Standards Institute (ANSI) Publication: C2-93 National Electrical Safety Code
- B. Electronic Industries Alliance and Telecommunication Industries Association (EIA/TIA) Publications:
 - 1. EIA/TIA 568A - Commercial Building Telecommunications Wiring Standard
 - 2. EIA/TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
- C. Institute of Electrical and Electronic Engineers (IEEE) Publication: 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- D. National Fire Protection Association (NFPA) Publication: 70-96 National Electrical Code (NEC)
- E. The California State University (CSU), Office of the Chancellor, Publication: Telecommunications Infrastructure Planning Guidelines, including any supplements
- F. Underwriters Laboratories, Inc. (U.L.) Publication:
 - 1. 83-1983 Thermoplastic Insulated Wires

2. 467-84 (R86) Grounding and Bonding

1.3 WORK SEQUENCING AND COORDINATION

- A. The Contractor shall coordinate interconnection to the University's existing grounding and bonding system with the University's Representative. All connections to the existing buildings systems should be performed without affecting the existing building grounding system. However, if any out of service activity is required, the work shall be coordinated a minimum of fourteen (14) days in advance with the University's Representative..

1.4 SUBMITTALS

Submit the following:

- A. Product data for:
 - 1. Ground bus bars
 - 2. Conductors
 - 3. Connections (all types)
- B. Test Reports for point-to-point resistance tests.
- C. Manufacturer's Instructions: include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.
- D. The Contractor shall submit a letter or product specification catalog from the manufacturer as evidence of the three years of documented experience listed above.

1.5 QUALITY ASSURANCE

- A. All grounding and bonding system work shall be tested and documented as defined in 3.4 below.
- B. For products or workmanship specified by association, trade, Federal, or State Standards, the Contractor shall comply with the requirements of the standard, except when more rigid requirements required by applicable codes.
- C. The Contractor shall conform to reference standard by date of issue current on final design documents.

1.6 PROJECT RECORD DOCUMENTS

- A. The Contractor shall accurately record and submit to the University's Representative complete data regarding signal ground wire pathways, points of bonding, and point of connection to building grounds.

1.7 QUALIFICATIONS

- A. Products specified in this Section shall be manufactured by a company with a minimum of three years' documented experience specializing in manufacturing such products.

1.8 REGULATORY REQUIREMENTS

- A. Telecommunications grounding and bonding shall conform to requirements of NFPA 70 and ANSI C2.
- B. The Contractor shall furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the University's Representative as suitable for purposes specified and shown.

1.9 PERFORMANCE REQUIREMENTS

- A. Point-to-Point Resistance: 0.5 ohms or less.

PART 2 MATERIALS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall conform to the respective standards and to the specifications stated herein. Electrical ratings shall be as indicated. Except where specifically indicated otherwise, the Contractor shall provide only new materials having all legally required approvals and/or labels. Materials shall conform to the requirements of UL 467 where applicable.

2.2 CONDUCTOR, UL 83

- A. Ground and bonding conductors shall be green-insulated, soft-drawn stranded copper conductors, unless otherwise indicated, installed with sufficient slack to avoid breaking due to settlement and movement of conductors or attached points.
- B. System grounding conductors shall be minimum of 3/0 AWG green insulated copper, unless otherwise indicated, and shall be continuous with no joints or splices.

2.3 CONNECTORS AND TERMINALS

- A. Wire Connectors and Terminals for use with Copper Conductors: UL 486A.

2.4 GROUND BUS BARS

- A. The Contractor shall provide (if not already available) ground bar with tapped standard NEMA bolt holes for 2-hole compression connectors, mounting brackets and insulators, sizes as indicated:
 - 1. 1/4" x 4" x 12", CPI, Hargar, Lyncole XIT or equal in the BDF and the network room.
 - 2. 1/4" x 4" x 5.25", CPI, Hargar, Lyncole XIT or equal in all other telecommunication spaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall provide grounding and bonding in accordance with the requirements of NFPA 70, IEEE 142, EIA/TIA 568, EIA/TIA 607, state and local codes, the campus standards and to requirements specified herein. Codes shall be complied with as a minimum requirement, with these specifications prevailing when they are more stringent.

3.2 BONDING

- A. Metallic conduits, wireways, metal enclosures of busways, cable boxes, equipment housings, cable racks and all non-current carrying metallic parts of the installed telecommunications services shall be grounded with #6 AWG green insulated copper wire. The metallic conduit system shall be used for equipment and enclosure grounding but not as a system ground conductor.
- B. All metallic conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
- C. Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Contractor shall use #6 AWG green insulated copper conductors.
- D. The Contractor shall bond telecommunications equipment and bus bars separately.

3.3 SIGNAL REFERENCE GROUNDING AND BONDING

- A. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
 - 1. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of EIA/TIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG green insulated copper wire.
 - 2. The Contractor shall provide, as a minimum, a continuous #3/0 AWG green insulated copper electrical conductor connected to a 1/4" x 4" x 5.25" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
 - 3. The ground wires from each individual IDF shall be routed directly to the Building Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 12" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG green insulated ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.

3.4 FIELD TESTS

- A. As an exception to requirements that may be stated elsewhere in these documents, the Inspector of Record shall be given five (5) working days notice prior to each test. The Contractor shall provide all test equipment and personnel and shall provide written copies of all test results.
- B. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.
- C. The Contractor shall provide personnel and test equipment for point-to-point resistance tests before connecting equipment. Perform point-to-point tests in each building to determine the resistance between the main grounding system and all BDF/IDF ground bus bars. Investigate and

correct point-to-point resistance values that exceed 0.5 ohm. The Contractor shall record resistance measurements at all test point locations and submit this record.

END OF SECTION

LIST OF DRAWINGS

SHEET NO.	TITLE	SHEET DATE
	COVER SHEET	03/23/2010
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A2.0B	BASEMENT LEVEL DEMO & NEW FLOOR & REFLECTIVE CEILING PLAN	03/23/2010
A2.1	1ST & 6TH FLOOR DEMO & NEW REFLECTIVE CEILING PLAN	03/23/2010
A2.2	SECOND FLOOR DEMO & NEW FLOOR & REFLECTIVE CEILING PLAN	03/23/2010
A2.7	7TH FLOOR DEMO & NEW FLOOR & REFLECTIVE CEILING PLAN	03/23/2010
A3.0	DOOR & FINISH SCHEDULE	03/23/2010
A4.0	BUILDING DETAILS	03/23/2010
S1.0	STRUCTURAL NOTES AND INFORMATION	03/23/2010
S2.0	BASEMENT AND FIRST FLOOR FRAMING PLAN	03/23/2010
S2.1	SECOND AND SEVENTH FLOOR FRAMING PLANS	03/23/2010
S3.0	STRUCTURAL DETAILS	03/23/2010
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HMA-02	HAZARDOUS MATERIALS A LEVEL FLOOR PLAN	03/23/2010
HMA-03	HAZARDOUS MATERIALS FIRST FLOOR PLAN	03/23/2010
HMA-04	HAZARDOUS MATERIALS SECOND FLOOR PLAN	03/23/2010
HMA-05	HAZARDOUS MATERIALS THIRD FLOOR PLAN	03/23/2010
HMA-06	HAZARDOUS MATERIALS FOURTH FLOOR PLAN	03/23/2010
HMA-07	HAZARDOUS MATERIALS FIFTH FLOOR PLAN	03/23/2010
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M0.1	GENERAL NOTES, LEGEND, EQUIPMENT SCHEDULES AND SHEET INDEX	03/23/2010
M2.0B	LEVEL 'B' MECHANICAL DEMO AND RENO ENLARGED PLANS	03/23/2010
M2.0A	LEVEL 'A' MECHANICAL DEMO AND RENO ENLARGED PLANS	03/23/2010
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P2.0	LEVEL 'A' PLUMBING DEMO AND RENO ENLARGED PLANS	03/23/2010
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SHEET NO.	TITLE	SHEET DATE
EC0.1	GENERAL NOTES, LEGEND AND DRAWING INDEX	03/23/2010
EC2.0B-1	TELECOM B LEVEL FLOOR PLAN	03/23/2010
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EC2.0A-2	TELECOM A LEVEL FLOOR PLAN	03/23/2010
EC2.1-1	TELECOM FIRST FLOOR PLAN	03/23/2010
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EC4.2	TELECOM DETAILS	03/23/2010
EC4.3	TELECOM DETAILS	03/23/2010

END OF LIST OF DRAWINGS