UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS
BUILDING 500 / 6TH FLOOR CANCER CENTER RENOVATION
SEPTEMBER 29, 2017

SPECIFICATIONS
CONSTRUCTION DOCUMENTS

BENNETT WAGNER GRODY
ARCHITECTS
UNIVERSITY OF COLORADO - ANSCHUTZ MEDICAL CAMPUS
UCD Building 500 - 6th Floor Cancer Center Renovation
UCD Project No. 17-289575

Construction Documents
September 29, 2017

INDEX

TABLE OF CONTENTS

PROJECT DIRECTORY

DIVISIONS 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

REQ UEST FOR R DO CUM EN TED QUOT E
DO CUM EN TED SC OP E TABLE O F C O N TEN TS
DO CUM EN TED QUOT E - 25K-150K - PO
IN FOR RMATIO N FOR R BIDDERS (State Form SPB-6.12)
BID (State Form SBP-6.13)
BID BON D (State Form SPB-6.14)
SUBCON TRAC TO R S STATEM EN T OF EXPERIEN CE (Not Used)
C O N STRUC TIO N PURCHASE O RDER TERMS AND CON DITIO NS
IN SURA NCE REQ UIREM EN TS (A)
SALES TAX EXEM PTIO N CERTIFICATES
C O N TRAC T R APPUCATIO N FOR EXEM PTIO N CERTIFICATES
SUPPLEMENTAL CHIEF KUST FOR PRO JECTS UNDER $100K (Not Used)
SERVICE-DISABLED VETERAN-O W NED SM ALL BUSIN ESS
AND M INORITY / WOMEN (Not Used)
BUSINESS ENTERPRISE PARTICIPANT REPORT (Not Used)
AUTHORIZATION TO BID (Not Used)

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 SUM MARY
01 18 00 PROJECT UTILITY SOURCES
01 21 00 ALLO WANCES
01 22 00 UNIT PRICES
01 23 00 ALTERNATES
01 25 00 SUBSTITUTIONS
01 26 00 CONSTRUCTION MODIFICATIONS
01 27 00 PAYMENTS
01 32 33 PHOTOGRAPHIC DOCUMENTATION
01 33 00 SUBMITTAL PROCEDURES
01 35 44 SPECIAL PROCEDURES FOR ENVIRONMENTAL HEALTH AND SAFETY
01 35 46 INDOOR AIR QUALITY
01 40 00 QUALITY REQUIREMENTS
01 41 00 REGULATORY REQUIREMENTS
01 50 00 TEMPORARY FACILITIES AND CONTROLS
01 60 00 PRODUCT REQUIREMENTS

INDEX
<table>
<thead>
<tr>
<th>Section No.</th>
<th>Section Title</th>
<th>No. of Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 73 00</td>
<td>EXECUTION</td>
<td>11</td>
</tr>
<tr>
<td>01 74 19</td>
<td>CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL</td>
<td>NA</td>
</tr>
<tr>
<td>01 77 00</td>
<td>CLOSET UTILITY EDURES</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>SUPPLEMENT TICAL EFFECTS OF CC UPANCY AND DUST USE LIST.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>SUPPLEMENTARY BUILDING / PROJECT ACCEPTANCE LIST</td>
<td>NA</td>
</tr>
<tr>
<td>01 78 23</td>
<td>OPERATIONAL AND M AINTENANCE AND CODE DATA</td>
<td>7</td>
</tr>
<tr>
<td>01 78 39</td>
<td>PROJECT RECORD COMPLETENESS</td>
<td>4</td>
</tr>
<tr>
<td>01 78 46</td>
<td>EXTRA STOCK MATERIALS</td>
<td>NA</td>
</tr>
<tr>
<td>01 79 00</td>
<td>DEMONSTRATION AND TRAINING</td>
<td>NA</td>
</tr>
</tbody>
</table>

DIVISION 02 - EXISTING CONDITIONS

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Section Title</th>
<th>No. of Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 41 19</td>
<td>SELECTIVE DEMOLITION</td>
<td>6</td>
</tr>
</tbody>
</table>

DIVISION 23 - HVAC

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Section Title</th>
<th>No. of Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 05 00</td>
<td>COMMON WORK RESULTS FOR HVAC</td>
<td>15</td>
</tr>
<tr>
<td>23 05 23</td>
<td>GENERAL DUTY VALVES FOR HVAC</td>
<td>5</td>
</tr>
<tr>
<td>23 07 00</td>
<td>MECHANICAL INSULATION IN SULATIN</td>
<td>8</td>
</tr>
<tr>
<td>23 08 00</td>
<td>START UP TESTING AND COMMUNICATIONS IN G W ITH AGENT T</td>
<td>3</td>
</tr>
<tr>
<td>23 31 00</td>
<td>HVAC DUCTS AND ACCESSORIES</td>
<td>16</td>
</tr>
<tr>
<td>23 36 00</td>
<td>AIR TERMINALS AND UNITS</td>
<td>3</td>
</tr>
<tr>
<td>23 37 00</td>
<td>AIR OUTLETS AND INLETS</td>
<td>2</td>
</tr>
</tbody>
</table>

DIVISION 26 - ELECTRICAL

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Section Title</th>
<th>No. of Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 05 00</td>
<td>COMMON WORK RESULTS FOR ELECTRICAL</td>
<td>6</td>
</tr>
<tr>
<td>26 05 19</td>
<td>COMMON DUCT TO RS AND D CABLES</td>
<td>5</td>
</tr>
<tr>
<td>26 05 29</td>
<td>HANDERS AND SUPPOR TIES FOR ELECTRICAL SYSTEMS</td>
<td>3</td>
</tr>
<tr>
<td>26 05 33</td>
<td>RACK EARS AND D BOXES</td>
<td>8</td>
</tr>
<tr>
<td>26 05 53</td>
<td>IDENTIFICATION FOR ELECTRICAL SYSTEMS</td>
<td>3</td>
</tr>
<tr>
<td>26 27 26</td>
<td>WIRING AND DEVICES</td>
<td>3</td>
</tr>
</tbody>
</table>
### UNIVERSITY OF COLORADO - ANSCHUTZ MEDICAL CAMPUS
**UCD Building 500 - 6th Floor Cancer Center Renovation**
**UCD Project No. 17-289575**

### PROJECT DIRECTORY

| **PROJECT** | University of Colorado Denver  
Building 500: 6th Floor Cancer Center Renovation |
|-------------|--------------------------------------------------------------------------------------------------|
| **PROJECT NUMBER** | UCD NO. 17-289575  
BWG NO. 17045.00 |
| **OWNER** | Robert Holzwarth  
robert.holzwarth@ucdenver.edu |
| **ARCHITECT** | Bennett Wagner Grody Architects  
1301 Wazee Street, Suite 100  
Denver, Colorado 80204  
303-623-7323  
303-623-2836 fax  
Matt Bartels  
mbartels@bwgarchitects.com  
Linda Wagner  
lwagner@bwgarchitects.com |
| **MECHANICAL, PLUMBING & ELECTRICAL** | The RMH Group, Inc.  
12600 West Colfax Avenue, Suite A-400  
Lakewood, CO 80215  
303-239-0909  
Michelle Swanson  
mswanson@rmhgroup.com  
303-239-2724 |
Request for Documented Quote
(Construction Purchase Order under $100K)

Project #: 17-289575
Project Name: B500 – 6th Floor Cancer Center Renovation

Documented Quote Due by (Date/Time): 10/20/2017, 2:00 PM

Project Manager: Robert Holzwarth
Email Address: robert.holzwarth@ucdenver.edu
Documented Quote Table of Contents
(Construction Purchase Order under $100K)

1. Advertisement for Documented Quote

2. Information to Bidders (SBP-6.12)
   NOTE: Electronic versions of all State Buildings (SBP and SC) forms can be found at
   https://www.colorado.gov/pacific/osa/formsproc

3. Bid Form (SBP-6.13)

4. Bid Alternates Form (SBP-6.131) – if used

5. Bid Bond (SBP-6.14) Not Included – Please Note: if the submitted Documented Quote is
   $50,000 or higher a Bid Bond is required

6. University of Colorado Denver Facilities Management Construction Purchase Order
   Terms and Conditions

7. Insurance Requirements (A), Construction Purchase Order Insurance Requirements
   University of Colorado Denver

8. As Applicable:
   University of Colorado Denver Supplemental Checklist for Projects Under 100K

9. Scope of Work
   Description/Specifications
   Plans/Other Supporting Documentation

Appendix A: University of Colorado Denver Tax Information
Agency: University of Colorado Denver | Anschutz Medical Campus
Notice Type: Documented Quote
Construction Cost Categories: Under $100K
Should this notice include print media information: No
Project No: 17-289575
Project Title: Building 500 6th Floor Cancer Center Renovation – SCPP Pre-Qualified Contractors Only
Project Description: The project includes the partial renovation of the west wing and north wing on the 6th Floor of Building 500 located on the University of Colorado Denver | Anschutz Medical Campus in Aurora, CO. The project scope includes reconfiguration of 5 private offices into 2 person shared offices and the interior renovation of 2 large workrooms into new open office space. Work includes, but is not limited to: miscellaneous demolition, new wall construction, acoustical ceilings, electrical, voice/data rough-in, lighting, HVAC modifications, floor finishes, patching and painting. Furniture procurement and installation will be contracted separately.

Project should be substantially completed within: 37 Calendar Days of issuance of P.O. (est. 11/29/17)
Project shall be finally complete within: 15 Calendar Days (after Substantial Completion, or approx. 12/14/2017)
Anticipated Construction Start Date: 10/23/17
Bidder may procure Bidding Documents from: http://www.ucdenver.edu/about/departments/FacilitiesManagement/FacilitiesProjects/RFP/Pages/RFP.aspx
Bid Documents will be available on 10/9/17
Deposit required for a complete set of Contract Documents: $0
ARRA Funding: No
Settlement Notices:
For all projects with a total dollar value above $150,000 Notice of Final Settlement is required by C.R.S. 38-26-107. Final Settlement, if required, will be advertised via Electronic Media
Scope of Services: N/A
Submission Details:
Submission Deadline: 10/20/2017, 4:00 PM
Submissions Accepted Via: Email  Fax  In Person  Mail
Details: All documented quotes shall be submitted to Robert Holzwarth – Robert.holzwarth@ucdenver.edu.
In addition to email and mail delivery options, documented quote submissions can also be hand delivered to: Facilities Projects, Room 310, 1945 Wheeling Street, Mail Stop F418, Aurora, CO 80045

Rev. 03/2013
Documented Quotes will be received from pre-qualified SCPP contractors only. Late bids will be disregarded. When noted that a completely executed form will be sent by certified mail to the Contractor, or any other means as agreed to, notice will be sent by electronic mail.

**Point of Contact:**

Name: Robert Holzwarth  
Agency: University of Colorado Denver | Anschutz Medical Campus  
Phone: (303) 724-0749  
Fax: (303) 724-0931  
Email: robert.holzwarth@ucdenver.edu

**Meetings:**

Choose one:

- Mandatory Pre-Bid

Date and Time: **10/12/2017, 2:00 PM**

Details: B500 Cancer Center Board Room C6004E - University of Colorado Denver | Anschutz Medical Campus, Aurora, CO 80045

Comments: Bids received from bidders who have not attended the mandatory pre-bid meeting will not be considered for the project. Questions will be collected until **10/16/2017 at 2:00 PM** from those who attended mandatory pre-bid meeting. Questions will be answered by **10/17/2017 at 4:00 PM**

**Specification Details/Attachments:**

Attachments: Construction Documents and Bid Manual will be available on the University web site on 10/9/2017.

**Media of Publications:**

Media of Publication:  
http://www.ucdenver.edu/about/departments/FacilitiesManagement/FacilitiesProjects/RFP/Pages/RFP.aspx

Publication Dates: **10/6/2017**
1. **BID FORM:** Bidders are required to use the Bid form attached to the bidding documents. Each bidder is required to bid on all alternates and indicate the time from the date of the Notice to Proceed to Substantial Completion in calendar days, and in addition, the bidder is required to indicate the period of time to finally complete the project from Substantial Completion to Final Acceptance, also in calendar days. Bids indicating times for Substantial Completion and Final Acceptance in excess of the number of days indicated in the Advertisement for Bids for completion of the entire Project may be found non-responsive and may be rejected. The bid shall not be modified or conditioned in any manner. Bids shall be submitted in sealed envelopes bearing the address and information shown below. If a bid is submitted by mail, this aforementioned sealed envelope should be enclosed in an outer envelope and sent to the following addressee:

**Facilities Projects, Room 310, 1945 Wheeling Street, Mail Stop F418, Aurora, CO 80045**

The outside of the sealed inner envelope should bear the following information:

- **Project #17-289575**
- **Project Name** Building 500 6th Floor Cancer Center Renovation
- **Name and Address of Bidder**
- **Date of Opening** 10/20/17
- **Time of Opening** 2:00 PM

2. **INCONSISTENCIES AND OMISSIONS:** Bidders may request clarification of any seeming inconsistencies, or matters seeming to require explanation, in the bidding documents at least three (3) business days prior to the time set for the opening of Bids. Decisions of major importance on such matters will be issued in the form of addendum.

3. **APPLICABLE LAWS AND REGULATIONS:** The bidder’s attention is called to the fact that all work under this Contract shall comply with the provisions of all state and local laws, approved state building codes, ordinances and regulations which might in any manner affect the work to be done or those to be employed in or about the work. Attention is also called to the fact that the use of labor for work shall be governed by the provisions of Colorado law which are hereinafter set forth in Articles 27 and 52E of the GENERAL CONDITIONS.

4. **UNAUTHORIZED IMMIGRANTS:** Note that the Special Provisions of the General Conditions of the Contract includes the following language: PUBLIC CONTRACTS FOR SERVICES - CRS 8-17.5-101 and PUBLIC CONTRACTS WITH NATURAL PERSONS - 24-76.5-101. The Contractor certifies that the Contractor shall comply with the provisions of CRS 8-17.5-101 et seq. The Contractor shall not knowingly employ or contract with an illegal alien to perform work under this contract or enter into a contract with a subcontractor that fails to certify to the Contractor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this contract. The Contractor represents, warrants, and agrees that if (i) it has verified that it does not employ any illegal aliens, through participation in the Basic Pilot Employment Verification Program administered by the Social Security Administration and Department of Homeland Security, and (ii) otherwise will comply with the requirements of CRS 8-17.5-102(2)(b). The Contractor shall comply with all reasonable requests made in the course of an investigation under CRS 8-17.5-102 by the Colorado Department of Labor and Employment. If the Contractor fails to comply with any requirement of this provision or CRS 8-17.5-101 et seq., the State may terminate this contract for breach and the Contractor shall be liable for actual and consequential damages to the State.

A Contractor that operates as a sole proprietor hereby swears or affirms under penalty of perjury that the Contractor (i) is a citizen of the United States or otherwise lawfully present in the United States pursuant to federal law, (ii) shall comply with the provisions of CRS 24-76.5-101 et seq, and (iii) shall produce one of the forms of identification required by CRS 24-76.5-103 prior to the effective date of this Contract. Except where
exempted by federal law and except as provided in CRS 24-76.5-103(3), a Contractor that receives federal or state funds under this contract must confirm that any individual natural person eighteen years of age or older is lawfully present in the United States pursuant to CRS 24-76.5-103(4) if such individual applies for public benefits provided under this contract.

5. **TAXES**: The bidder’s attention is called to the fact that the Bid submitted shall exclude all applicable federal excise or manufacturers’ taxes and all state sales and use taxes as hereinafter set forth in Article 9C of the GENERAL CONDITIONS.

6. **OR EQUAL**: The words “OR EQUAL” are applicable to all specifications and drawings relating to materials or equipment specified. Any material or equipment that will fully perform the duties specified, will be considered “equal”, provided the bid submits proof that such material or equipment is of equivalent substance and function and is approved, in writing. Requests for the approval of “or equal” shall be made in writing at least five (5) business days prior to bid opening. During the bidding period, all approvals shall be issued by the Architect/Engineer in the form of addenda at least two (2) business days prior to the bid opening date.

7. **ADDENDA**: Owner/architect initiated addenda shall not be issued later than two (2) business days prior to bid opening date. All addenda shall become part of the Contract Documents and receipt must be acknowledged on the Bid form.

8. **METHOD OF AWARD - LOWEST RESPONSIBLE BIDDER**: If the bidding documents for this project require alternate prices, additive and/or deductible alternates shall be listed on the alternates bid form provided by the Principal Representative. Bidders should note the Method of Award is applicable to this Bid as stated below.

   A. **DEDUCTIBLE ALTERNATES**: The lowest responsible Bid, taking into account the Colorado resident bidder preference provision of Colorado law, will be determined by and the contract will be awarded on the base bid combined with deductible alternates, deducted in numerical order in which they are listed in the alternates bid form provided by the Principal Representative. The subtraction of alternates shall result in a sum total within available funds. If this bid exceeds such amount, the right is reserved to reject all bids. An equal number of alternates shall be subtracted from the base bid of each bidder within funds available for purposes of determining the lowest responsible bidder.

   B. **ADDITIVE ALTERNATES**: The lowest responsible Bid, taking into account the Colorado resident bidder preference provision of Colorado law, will be determined by and the contract will be awarded on the base bid plus all additive alternates added in the numerical order in which they are listed in the alternates bid form provided by the Principal Representative. The addition of alternates shall result in a sum total within available funds. If this bid exceeds such amount, the right is reserved to reject all bids. An equal number of alternates shall be added to the base bid of each bidder within funds available for purposes of determining the lowest responsible bidder.

   C. **DEDUCTIBLE AND ADDITIVE ALTERNATES**: Additive alternates will not be used if deductible alternates are used and deductible alternates will not be used if additive alternates are used.

9. **NOTICE OF CONTRACTOR’S SETTLEMENT** – Agencies/institutions must indicate in the initial Solicitation (Advertisement for Bids, Documented Quotes, or Requests for Proposals) whether settlement will be advertised in newspapers or electronic media.

The Advertisement for Bids can be located at the web site: [www.colorado.gov/pacific/osa/cdnotices](http://www.colorado.gov/pacific/osa/cdnotices)
(Click on the appropriate link [ColoradoVSS or ColoradoBIDS] or on the State Purchasing Office website)
Bidder acknowledges receipt of addenda numbers:

Bidder anticipates services outside the United States or Colorado:

Bidder will comply with 80% Colorado Labor on project above $500,000:

Bidder is a Service-Disabled Veteran Owned Small Business:

Base Bid

(Refer to Bid Alternate Form SC-6.13.1 Attached, If Applicable)

Bidder's Time of Completion

a. Time Period from Notice to Proceed to Substantial Completion:

b. Time Period from Substantial Completion to Final Acceptance:

c. Total Time of Completion of Entire Project (a + b):

1. BID: Pursuant to the advertisement by the State of Colorado dated ________, the undersigned bidder hereby proposes to furnish all the labor and materials and to perform all the work required for the complete and prompt execution of everything described or shown in or reasonably implied from the Bidding Documents, including the Drawings and Specifications, for the work and for the base bid indicated above. Bidders should include all taxes that are applicable.

2. EXAMINATION OF DOCUMENTS AND SITE: The bidder has carefully examined the Bidding Documents, including the Drawings and Specifications, and has examined the site of the Work, so as to make certain of the conditions at the site and to gain a clear understanding of the work to be done.

3. PARTIES INTERESTED IN BID: The bidder hereby certifies that the only persons or parties interested in this Bid are those named herein, and that no other bidder or prospective bidder has given any information concerning this Bid.

A. If the bidder anticipates services under the contract or any subcontracts will be performed outside the United States or Colorado, the bidder shall provide in a written statement which must include, but need not be limited to the type of services that will be performed at a location outside the United States or Colorado and the reason why it is necessary or advantageous to go outside the United States or Colorado to perform such services. (Does not apply to any project that receives federal moneys)

B. For State Public Works projects per C.R.S. 8-17-101, Colorado labor shall be employed to perform at least 80% of the work. Colorado labor means any person who is a resident of the state of Colorado at the time of the Public Works project. Bidders indicating that their bid proposal will not comply with the 80% Colorado Labor requirement are required to submit written justification along with the bid submission. (Does not apply to any project that receives federal moneys)

C. A Service-Disabled Veteran Owned Small Business (SDVOSB) per C.R.S. 24-103-211, means a business that is incorporated or organized in Colorado or maintains a place of business or has an office in Colorado and is officially registered and verified by the Center for Veteran Enterprise within the U.S. Department of Veteran Affairs. Attach proof of certification along with the bid submission.

4. BID GUARANTEE: This Bid is accompanied by the required Bid Guarantee. You are authorized to hold said Bid Guarantee for a period of not more than thirty (30) days after the opening of the Bids for the work above indicated, unless the undersigned bidder is awarded the Contract, within said period, in which event the Director, State Buildings Programs, may retain said Bid Guarantee, until the undersigned bidder has executed the required Agreement and furnished the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance and Affidavit Regarding Unauthorized Immigrants.

5. TIME OF COMPLETION: The bidder agrees to achieve Substantial Completion of the Project from the date of the Notice to Proceed within the number of calendar days entered above, and in addition, further agrees that the period between Substantial Completion and Final Acceptance of the Project will not exceed the number of calendar days noted above. If awarded the Work, the bidder agrees to begin performance within ten (10) days from
the date of the Notice to Proceed subject to Article 46, Time of Completion and Liquidated Damages of The General Conditions of the Contract, and agrees to prosecute the Work with due diligence to completion. The bidder represents that Article 7D of the Contractor’s Agreement (SC-6.21) has been reviewed to determine the type and amount of any liquidated damages that may be specified for this contract.

6. EXECUTION OF DOCUMENTS: The bidder understands that if this Bid is accepted, bidder must execute the required Agreement and furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance and Affidavit Regarding Unauthorized Immigrants within ten (10) days from the date of the Notice of Award, and that the bidder will be required to sign to acknowledge and accept the Contract Documents, including the Drawings and Specifications.

7. ALTERNATES: Refer to the Information for Bidders (SC-6.12) for Method of Award for Alternates and use State Form SBP-6.13.1 Bid Alternates form to be submitted with this bid form if alternates are requested by the institution/agency in the solicitation documents.

8. Submit wage rates (direct labor costs) for prime contractor and subcontractor as requested by the institution/agency in the solicitation documents.

9. The right is reserved to waive informalities and to reject any and all Bids.

SIGNATURES: If the Bid is being submitted by a Corporation, the Bid shall be signed by an officer, i.e., President or Vice-President. If a sole proprietorship or a partnership is submitting the Bid, the Bid shall so indicate and be properly signed.

Dated this _____ Day of __________________ , 20_____  

THE BIDDER:  
Company Name  Address (including city, state and zip)  
Phone number:  

Name (Print) and Title  Signature
KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, the Principal, hereinafter called the "PRINCIPAL", is submitting a Proposal for the above described project, to the STATE OF COLORADO, hereinafter called the "OBLIGEE".

WHEREAS, the Advertisement for Bids has required as a condition of receiving the Proposals that the Principal submit with the Proposal Guaranty in an amount not less than five per cent (5%) of the Proposal, which sum it is specifically agreed is to be forfeited as Liquidated Damages in the event that the Principal defaults in his obligation as hereinafter specified, and, in pursuance of which Requirement, this Bid is made, executed and delivered.

NOW THEREFORE, the Principal and a corporation of the State of , duly authorized to transact business in Colorado, as Surety, are held and firmly bound unto the Obligee, in the sum of five per cent (5%) of the Principal's total bid price, lawful money of the United States for the payment of which sum, well and truly to be made to the Obligee, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

FURTHER THAT, a condition of the obligation that the Principal shall maintain his Proposal in full force and effect for thirty (30) days after the opening of the proposals for the project, or, if the Principal's Proposal is accepted, the Principal shall, within the prescribed time, execute the required Agreement, furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy, Certificates of Insurance and Certification and Affidavit Regarding Illegal Aliens, then this obligation shall be null and void, otherwise it shall remain in full force and effect, and subject to forfeiture upon demand as Liquidated Damages.

IN WITNESS WHEREOF said Principal and Surety have executed this Bond, this day of , A.D., 20 .

(Corporate Seal)

THE PRINCIPAL

Company Name

Address (including city, state and zip)

Phone number:

Name (Print) and Title

ATTEST

Secretary

Signature

Name (Print)

SIGNATURES

If the "Principal" is doing business as a Corporation, the Bid Bond shall be signed by an officer, i.e., President or Vice President. The signature of the officer shall be attested to by the Secretary and properly sealed.

If the "Principal" is an individual or a partnership, the Bid Bond shall do indicate and be properly signed.

(Corporate Seal)

THE SURETY

By

Attorney-in-Fact

Secretary

This bond must be accompanied by power of attorney, effectively dated. Failure to provide a properly executed bid bond with a properly executed power of attorney will result in the bidder's proposal being deemed non-responsive.

State Form SBP-6.14
Rev. 10/2006
Facilities Management
Construction Purchase Order Terms and Conditions

1. Offer/Acceptance

If this purchase order ("PO") refers to vendor's bid or proposal, this PO is an ACCEPTANCE of vendor's OFFER TO SELL in accordance with the terms and conditions of the "solicitation" identified in vendor's bid or proposal. The solicitation includes an RFP, IFB, or any other form of order by the University. If a bid or proposal is not referenced, this PO is an OFFER TO BUY, subject to vendor's acceptance, demonstrated by vendor's performance or written acceptance of this PO. Any COUNTER-OFFER TO SELL automatically CANCELS this PO, unless a change order is issued by the University accepting a counter-offer. This PO shall supersede and control over any vendor form(s) or part(s) thereof included in or attached to any bid, proposal, offer, acknowledgment, or otherwise, in the event of inconsistencies or contradictions, regardless of any statement to the contrary in such form(s) or parts thereof.

2. Safety Information

All chemicals, equipment and materials proposed and/or used in the performance of this PO shall conform to the requirements of the Occupational Safety and Health Act of 1970. Vendor shall furnish all Material Safety Data Sheets (MSDS) for any regulated chemicals, equipment or hazardous materials at the time of delivery.

3. Changes

Vendor shall furnish products and/or services strictly in accordance with the specifications and price set forth for each item. This PO shall not be modified, superseded or otherwise altered, except in writing signed by purchasing agent and accepted by vendor. Each shipment received or service performed shall comply with the terms of this PO, notwithstanding invoice terms or acts of vendor to the contrary, unless this PO has been modified, superseded or otherwise altered in accordance with this section.

4. Delivery

Unless otherwise specified in the solicitation or this PO, delivery shall be FOB destination. The University is relying on the promised delivery date, installation, and/or service performance set forth in vendor's bid or proposal as material and basic to the University's acceptance. If vendor fails to deliver or perform as and when promised, the University in its sole discretion, may cancel its order, or any part thereof, without prejudice to its other rights, return all or part of any shipment so made, and charge vendor with any loss or expense sustained as a result of such failure to deliver or perform as promised. Time is of the essence.

5. Intellectual Property

Any software, research, reports, studies, data, photographs, negatives or other documents, drawings or materials (collectively "materials") delivered by vendor in performance of its obligations under this PO shall be the exclusive property of the University. Ownership rights shall include, but not be limited to, the right to copy, publish, display, transfer, prepare derivative works, or otherwise use the materials. Vendor shall comply with all applicable laws, regulations and University policies related to confidential information and all confidentiality and non-disclosure agreements, security controls, and reporting requirements.

6. Quality
The University shall be the sole judge in determining "equals" with regard to quality, price and performance. All products delivered shall be newly manufactured and the current model, unless otherwise specified.

7. Warranties

All provisions and remedies of the Colorado Uniform Commercial Code, CRS, Title 4 ("CUCC"), relating to implied and/or express warranties are incorporated herein, in addition to any warranties contained in this PO or the specifications.

8. Inspections and Acceptance

Final acceptance is contingent upon completion of all applicable inspection procedures. If products or services fail to meet any inspection requirements, the University may exercise all of its rights, including those provided in the CUCC. The University shall have the right to inspect services provided under this PO at all reasonable times and places. "Services" as used in this section includes services performed or tangible material produced or delivered in the performance of services. If any of the services do not conform to PO requirements, the University may require vendor to perform the services again in conformity with PO requirements, without additional payment. When defects in the quality or quantity of service cannot be corrected by re-performance, the University may (a) require vendor to take necessary action to ensure that future performance conforms to PO requirements and (b) equitably reduce the payment due vendor to reflect the reduced value of the services performed. These remedies do not limit the remedies otherwise available in this PO, at law, or in equity.

9. Cash Discount

The cash discount period will start from the later of the date of receipt of acceptable invoice, or from date of receipt of acceptable products/services at the specified destination by an authorized University representative.

10. Taxes

The University is exempt from all federal excise taxes under Chapter 32 of the Internal Revenue Code and from all State and local government sales and use taxes [CRS, Title 39, Article 26, Parts I and II].

11. Payment

The University shall pay vendor for all amounts due within 30 days after receipt of products or services and a correct notice of amount due. Interest on the unpaid balance shall begin to accrue on the 46th day at the applicable statutory rate. Interest shall not accrue if a good faith dispute exists as to the University's obligation to pay all or a portion of the amount due. Vendor shall invoice the University separately for interest on delinquent amounts due, referencing the delinquent payment, number of day's interest to be paid, and applicable interest rate.

12. Vendor Offset

[Not Applicable to Inter-governmental POs] The University may withhold payment as required under the State vendor offset intercept system for debts owed for: (a) unpaid child support debts or arrearages; (b) unpaid balances of tax, accrued interest, or other charges specified in CRS § 39-21-101, et seq.; (c) unpaid loans due to the Student Loan Division of the Department of Higher Education; (d) amounts required to be paid to the Unemployment Compensation Fund; and (e) other unpaid debts owing to the University.

13. Assignment and Successors
Vendor shall not assign rights or delegate duties under this PO, or subcontract any part of the performance required under this PO, without the express, written consent of the University. This PO shall inure to the benefit of and be binding upon vendor and the University and their respective successors and assigns. Assignment of accounts receivable may be made only upon written notice furnished to the University.

14. Indemnification

If any article sold or delivered under this PO is covered by a patent, copyright, trademark, or application therefore, vendor shall indemnify and hold harmless the University from any and all loss, liability, cost, expenses and legal fees incurred on account of any claims, legal actions or judgments arising out of manufacture, sale or use of such article in violation or infringement of rights under such patent, copyright, trademark or application. If this PO is for services, vendor shall indemnify, save, and hold harmless the University, its employees and agents, against any and all claims, damages, liability and court awards including costs, expenses, and attorney fees and related expenses, incurred as a result of any act or omission by vendor, or its employees, agents, subcontractors or assignees, arising out of or in connection with performance of services under this PO.

15. Independent Contractor

Vendor shall perform its duties hereunder as an independent contractor and not as an employee. Neither vendor nor any agent or employee of vendor shall be deemed to be an agent or employee of the University. Vendor and its employees and agents are not entitled to unemployment insurance or workers compensation benefits through the University and the University shall not pay for or otherwise provide such coverage for vendor or any of its agents or employees. Unemployment insurance benefits will be available to vendor and its employees and agents only if coverage is made available by vendor or a third party. Vendor shall pay when due all applicable employment, income, and local head taxes incurred pursuant to this PO. Vendor shall not have authorization, express or implied, to bind the University to any agreement, liability or understanding. Vendor shall (a) provide and keep in force workers' compensation and unemployment compensation insurance in the amounts required by law, (b) provide proof thereof when requested by the University, and (c) be solely responsible for its acts and those of its employees and agents.

16. Communication

All communication concerning administration of this PO, prepared by vendor for the University's use, shall be furnished solely to purchasing agent.

17. Compliance

Vendor shall strictly comply with all applicable federal and state laws, rules, and regulations in effect or hereafter established, including, without limitation, laws applicable to discrimination and unfair employment practices.

18. Insurance

Vendor shall obtain, and maintain, at all times during the term of this PO, insurance as specified in the solicitation, and provide proof of such coverage as requested by the University's purchasing agent.

19. Termination Prior to Shipment

If vendor has not accepted this PO in writing, the University may cancel this PO by written or oral notice to vendor prior to shipment of goods or commencement of services.
20. Termination for Cause

(a) If vendor refuses or fails to timely and properly perform any of its obligations under this PO with such diligence as will ensure its completion within the time specified herein, the University may notify vendor in writing of non-performance and, if not corrected by vendor within the time specified in the notice, terminate vendor's right to proceed with the PO or such part thereof as to which there has been delay or a failure. Vendor shall continue performance of this PO to the extent not terminated and be liable for excess costs incurred by the University in procuring similar goods or services elsewhere. Payment for completed services performed and accepted shall be at the price set forth in this PO. (b) The University may withhold amounts due to vendor as the University deems necessary to reimburse the University for excess costs incurred in curing, completing or procuring similar goods and services. (c) If after rejection, revocation, or other termination of vendor's right to proceed under the CUCC or this clause, the University determines for any reason that vendor was not in default or the delay was excusable, the rights and obligations of the University and vendor shall be the same as if the notice of termination had been issued pursuant to termination under § 21.

21. Termination in Public Interest

The University is entering into this PO for the purpose of carrying out the public policy of the State and University, as determined by the Governor, General Assembly and Courts of the State of Colorado and the University of Colorado Board of Regents. If this PO ceases to further the public policy of the State or University, the University, in its sole discretion, may terminate this PO in whole or in part and such termination shall not be deemed to be a breach of the University's obligations hereunder. This section shall not apply to a termination for vendor's breach, which shall be governed by Item 20 (Termination for Cause). The University shall give written notice of termination to vendor specifying the part of the PO terminated and when termination becomes effective. Upon receipt of notice of termination, vendor shall not incur further obligations except as necessary to mitigate costs of performance. For services or specially manufactured goods, the University shall pay (a) reasonable settlement expenses, (b) the PO price or rate for supplies and services delivered and accepted, (c) reasonable costs of performance on unaccepted supplies and services, and (d) a reasonable profit for the unaccepted work. For existing goods, the University shall pay (e) reasonable settlement expenses, (f) the PO price for goods delivered and accepted, (g) reasonable costs incurred in preparation for delivery of the undelivered goods, and (h) a reasonable profit for the preparatory work. The University's termination liability under this section shall not exceed the total PO price plus a reasonable cost for settlement expenses. Vendor shall submit a termination proposal and reasonable supporting documentation, and cost and pricing data as required by CRS § 24-106-101, upon request of the University.

22. PO Approval

This PO shall not be valid unless it is executed by purchasing agent. The University shall not be responsible or liable for products or services delivered or performed prior to proper execution hereof.

23. Fund Availability

Financial obligations of the University payable after the current fiscal year are contingent upon funds for that purpose being budgeted and otherwise made available. If this PO is funded in whole or in part with federal funds, this PO is subject to and contingent upon the continuing availability of federal funds for the purposes hereof. The University represents that it has set aside sufficient funds to make payment for goods delivered in a single installment, in accordance with the terms of this PO.

24. Choice of Law

Colorado laws, rules and regulations shall be applied in the interpretation, execution, and enforcement of this PO. The CUCC shall govern this PO in the case of goods unless otherwise agreed in this PO. Any provision included or incorporated herein by reference which conflicts with such laws, rules, and
regulations is null and void. Any provision incorporated herein by reference which purports to negate this or any other provision in this PO in whole or in part shall not be valid or enforceable or available in any action at law, whether by way of complaint, defense, or otherwise. Unless otherwise specified in the solicitation or this PO, venue for any judicial or administrative action arising out of or in connection with this PO shall be in Denver, Colorado. Vendor shall exhaust administrative remedies in CRS § 24-109-106, prior to commencing any judicial action against the University.

25. Sensitive Data

To the extent vendors comes in contact with individual personal data owned or otherwise held by the University including employee, student, or medical information or records as a result of performing under this PO (“Data”), vendor agrees to use such Data, if at all, only to the extent required to perform its obligations under this PO, and to abide by the requirements of any federal, state and local laws that address the protection and/or use of such Data.

26. Background Checks

Contractor acknowledges that Contractor’s activities may involve heightened risks as a result of access or exposure by Contractor’s employees or agents to one or more Sensitive Environments. Contractor expressly acknowledges that Contractor shall take all commercially reasonable measures to mitigate any such risks, which measures may include but are not limited to conducting criminal history checks, financial background checks, or reference checks on employees or agents who will have access to one or more Sensitive Environments. For purposes of this provision, Sensitive Environment means any situation where Contractor’s employees or agents: (a) are engaged in supervision of or exposure to minors or other vulnerable populations; (b) have access to confidential information, which includes any information protected or restricted by law or University policy or that is expressly identified by the University as confidential information; (c) have access to the University’s information technology systems; (d) are engaged in activities that involve unique or specialized risks.

27. Public Contracts for Service

[Not Applicable to offer, issuance, or sale of securities, investment advisory services, fund management services, sponsored projects, intergovernmental POs, or information technology services or products and services] Vendor certifies, warrants, and agrees that it does not knowingly employ or contract with an illegal alien who will perform work under this PO and will confirm the employment eligibility of all employees who are newly hired for employment in the United States to perform work under this PO, through participation in the E-Verify Program or the Department program established pursuant to CRS § 8-17.5-102(5)(c), Vendor shall not knowingly employ or contract with an illegal alien to perform work under this PO or enter into a contract or PO with a subcontractor that fails to certify to vendor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this PO. Vendor shall (a) not use E-Verify Program or Department program procedures to undertake pre-employment screening of job applicants during performance of this PO, (b) notify subcontractor and the University within three days if vendor has actual knowledge that subcontractor is employing or contracting with an illegal alien for work under this PO, (c) terminate the subcontract if subcontractor does not stop employing or contracting with the illegal alien within three days of receiving notice, and (d) comply with reasonable requests made in the course of an investigation, undertaken pursuant to CRS § 8-17.5-102(5), by the Colorado Department of Labor and Employment. If vendor participates in the Department program, vendor shall deliver to the University a written, notarized affirmation that vendor has examined the legal work status of such employee, and shall comply with all of the other requirements of the Department program. If vendor fails to comply with any requirement of this provision or CRS § 8-17.5-101 et seq., the University may terminate this PO for breach and, if so terminated, vendor shall be liable for damages.

28. Public Contracts with Natural Persons
Vendor, if a natural person eighteen (18) years of age or older, hereby swears and affirms under penalty of perjury that he or she (a) is a citizen or otherwise lawfully present in the United States pursuant to federal law, (b) shall comply with the provisions of CRS § 24-76.5-101 et seq., and (c) has produced a form of identification required by CRS § 24-76.5-103 prior to the date vendor delivers goods or begins performing services under terms of the PO.

29. Governmental Immunity.

No term or condition of this contract shall be construed or interpreted as a waiver, express or implied, of any of the immunities, rights, benefits, protections, or other provisions, of the Colorado Governmental Immunity Act, CRS §24-10-101 et seq., or the Federal Tort Claims Act, 28 U.S.C. §§1346(b) and 2671 et seq., as applicable now or hereafter amended.


The signatories aver that to their knowledge, no employee of the University has any personal or beneficial interest whatsoever in the service or property described in this contract. Contractor has no interest and shall not acquire any interest, direct or indirect, that would conflict in any manner or degree with the performance of Contractor's services and Contractor shall not employ any person having such known interests.

31. Federal Flowdown Provisions for Federally Funded Contracts

The University of Colorado has entered into an Agreement with either the U.S. Government, or another entity who has itself entered into an Agreement with the U.S. Government. That Agreement requires that certain federal contract provisions be made a part of any subsequent Purchase Order issued by the University of Colorado related to furthering the performance or deliverables required under that Agreement.

Where necessary to make the context of these provisions applicable to this order, the term "contractor" shall mean "seller," the term "contract" shall mean "this order," and the terms "Government," "contracting officer," and equivalent phrases shall mean "the University." Seller hereby agrees to flowdown the applicable clauses to its lower-tier subcontractors, and agrees that the clauses are in effect between it and the University, as applicable.

The following provisions are from the Federal Acquisition Regulations (FAR), which are available online. (NOTE: These FAR clauses may have applicability only when the Purchase Order is at or in excess of a certain dollar threshold, shown in parentheses, or under certain circumstances.)

<table>
<thead>
<tr>
<th>FAR Citation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.203-6</td>
<td>Restrictions on Subcontractor Sales to the Government ($100,000)</td>
</tr>
<tr>
<td>52.203-7</td>
<td>Anti-Kickback Procedures except Subparagraph (c)(1) ($100,000)</td>
</tr>
<tr>
<td>52.203-12</td>
<td>Limitation on Payments to Influence Certain Federal Transactions ($100,000)</td>
</tr>
<tr>
<td>52.204-2</td>
<td>Security Requirements (applicable if access to classified material is involved) ($0)</td>
</tr>
<tr>
<td>52.215-2</td>
<td>Audit and Records -- Negotiation ($100,000)</td>
</tr>
<tr>
<td>52.215-10</td>
<td>Price Reduction for Defective Cost or Pricing Data ($550,000)</td>
</tr>
<tr>
<td>52.215-12</td>
<td>Subcontractor Cost or Pricing Data ($550,000)</td>
</tr>
<tr>
<td>52.215-13</td>
<td>Subcontractor Cost or Pricing Data -- Modifications ($550,000)</td>
</tr>
<tr>
<td>FAR Citation</td>
<td>Title</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>52.215-14</td>
<td>Integrity of Unit Prices ($100,000)</td>
</tr>
<tr>
<td>52.219-8</td>
<td>Utilization of Small Business Concerns ($100,000)</td>
</tr>
<tr>
<td>52.219-9</td>
<td>Small Business and Small Disadvantaged Business Subcontracting Plans (Large Businesses) ($650,000)</td>
</tr>
<tr>
<td>52.219-16</td>
<td>Liquidated Damages -- Subcontracting Plan ($650,000)</td>
</tr>
<tr>
<td>52.222-4</td>
<td>Contract Work Hours and Safety Standards Act -- Overtime Compensation ($100,000)</td>
</tr>
<tr>
<td>52.222-21</td>
<td>Prohibition of Segregated Facilities ($10,000)</td>
</tr>
<tr>
<td>52.222-26</td>
<td>Equal Opportunity ($10,000)</td>
</tr>
<tr>
<td>52.222-35</td>
<td>Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era ($25,000)</td>
</tr>
<tr>
<td>52.222-36</td>
<td>Affirmative Action for Workers with Disabilities ($10,000)</td>
</tr>
<tr>
<td>52.222-37</td>
<td>Employment Reports on Disabled Veterans and Veterans of the Vietnam Era ($25,000)</td>
</tr>
<tr>
<td>52.223-2</td>
<td>Clean Air and Water (applicable on orders issued under contracts solicited and issued prior to February 25, 2000)</td>
</tr>
<tr>
<td>52.223-6</td>
<td>Drug-Free Workplace (for individuals, $0; for non-individuals, $100,000)</td>
</tr>
<tr>
<td>52.223-7</td>
<td>Notice of Radioactive Materials (applicable if radioactive materials are involved) ($0)</td>
</tr>
<tr>
<td>52.223-14</td>
<td>Toxic Chemical Release Reporting ($100,000; N/A for acquisition of commercial items)</td>
</tr>
<tr>
<td>52.224-2</td>
<td>Privacy Act (applicable if vendor is supplying design, development, or operation of a system of records on individuals) ($0)</td>
</tr>
<tr>
<td>52.225-3</td>
<td>Buy American Act - Free Trade Agreements - Israeli Trade Act ($0)</td>
</tr>
<tr>
<td>52.225-13</td>
<td>Restrictions on Certain Foreign Purchases ($2,500)</td>
</tr>
<tr>
<td>52.226-1</td>
<td>Utilization of Indian Organizations and Indian-Owned Economic Enterprises ($0)</td>
</tr>
<tr>
<td>52.227-1</td>
<td>Authorization and Consent (applicable if in excess of the simplified acquisition threshold)</td>
</tr>
<tr>
<td>52.227-2</td>
<td>Notice and Assistance Regarding Patent and Copyright Infringement (applicable if in excess of the simplified acquisition threshold)</td>
</tr>
<tr>
<td>52.227-10</td>
<td>Filing of Patent Applications -- Classified Subject Matter ($0)</td>
</tr>
<tr>
<td>52.227-11</td>
<td>Patent Rights -- Retention by the Contractor (Short Form) ($0)</td>
</tr>
<tr>
<td>52.227-14</td>
<td>Rights in Data - General ($0)</td>
</tr>
<tr>
<td>52.230-5</td>
<td>Cost Accounting Standards -- Educational Institutions ($500,000)</td>
</tr>
<tr>
<td>52.230-6</td>
<td>Administration of Cost Accounting Standards ($500,000)</td>
</tr>
<tr>
<td>52.244-6</td>
<td>Subcontract for Commercial Items and Commercial Components ($0; non-commercial supplies or services)</td>
</tr>
</tbody>
</table>
In addition, if federal funds through a contract from an agency of the Department of Defense are involved, the following Department of Defense Federal Acquisition Regulations (DFAR) clauses apply. DFAR clauses are available online.
(NOTE: These DFAR clauses may have applicability only when the Purchase Order is at or in excess of a certain dollar threshold, shown in parentheses, or under certain circumstances.)

<table>
<thead>
<tr>
<th>DFAR Citation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>252.203-7001</td>
<td>Prohibition on Persons Convicted of fraud or Other Defense-Contract Related Felonies (not applicable for commercial items) (applicable if at or in excess of the simplified acquisition threshold)</td>
</tr>
<tr>
<td>252.209-7000</td>
<td>Acquisition from Subcontractors Subject to On-Site Inspection Under the Intermediate Range Nuclear Forces (INF) Treaty (applicable if at or in excess of the simplified acquisition threshold) (not applicable for commercial items)</td>
</tr>
<tr>
<td>252.227-7013</td>
<td>Rights in Technical Data -- Noncommercial Items (0)</td>
</tr>
<tr>
<td>252.227-7014</td>
<td>Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation</td>
</tr>
<tr>
<td>252.227-7034</td>
<td>Patents - Subcontracts ($0, for experimental, developmental, or research work to be performed by other than a small business firm or non-profit organization)</td>
</tr>
<tr>
<td>252.231-7000</td>
<td>Supplemental Cost Principles (0)</td>
</tr>
</tbody>
</table>

In addition, if federal funds through a contract from the National Aeronautic and Space Administration (NASA) are involved, the following NASA Supplemental Federal Acquisition Regulations (FAR) clauses apply. NASA clauses are available online.
(NOTE: These NASA clauses may have applicability only when the Purchase Order is at or in excess of a certain dollar threshold, shown in parentheses, or under certain circumstances.)

<table>
<thead>
<tr>
<th>NASA Citation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1852.208-81</td>
<td>Restrictions on Printing and Duplicating, Oct 2001 (0)</td>
</tr>
<tr>
<td>1852.219-74</td>
<td>Use of Rural Area Small Businesses, Sept 1990 (0)</td>
</tr>
<tr>
<td>1852.219-75</td>
<td>Small Business Subcontracting Reporting, May 1999 ($500,000)</td>
</tr>
<tr>
<td>1852.223-70</td>
<td>Safety and Health, April 2002 ((1) Amount to $1,000,000 or more (unless Contracting Officer makes a written determination, after consultation with installation safety and health representatives, that this is not required); (2) Require construction, repair, or alteration in excess of $25,000; or (3) Regardless of dollar amount, involve the use of hazardous materials or operations.)</td>
</tr>
<tr>
<td>1852.227-70</td>
<td>New Technology, May 2002 ($0, for the performance of experimental, developmental, or research work)</td>
</tr>
</tbody>
</table>
30. Federal Flowdown Provisions for Federally Funded Grants

The University of Colorado has entered into an Agreement with either the U.S. Government, or another entity who has itself entered into an Agreement with the U.S. Government. That Agreement requires that certain federal grant provisions be made a part of any subsequent Purchase Order issued by the University of Colorado related to furthering the performance or deliverables required under that Agreement.

Where necessary to make the context of these provisions applicable to this order, the term "contractor" shall mean "seller," the term "contract" shall mean "this order," and the terms "Government," "contracting officer," and equivalent phrases shall mean "the University." Seller hereby agrees to flowdown the applicable clauses to its lower-tier subcontractors, and agrees that the clauses are in effect between it and the University, as applicable.

Performance by the seller under this Purchase Order constitutes certification that the seller is presently in compliance with, and will continue to comply with, the Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) and Executive Orders Numbers 12549 and 12689, all as described below.

Equal Employment Opportunity


All contracts and subgrants in excess of $2000 for construction or repair awarded by recipients and subrecipients shall include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. 874), as supplemented by Department of Labor regulations (29 CFR part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled. The recipient shall report all suspected or reported violations to the Federal awarding agency.

Davis-Bacon Act, as amended (40 U.S.C. 276a to a-7)

When required by Federal program legislation, all construction contracts awarded by the recipients and subrecipients of more than $2000 shall include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 276a to a-7) and as supplemented by Department of Labor regulations (29 CFR part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction"). Under this Act, contractors shall be required to pay wages to laborers and mechanics at a rate not less than the minimum wages specified in a wage determination made by the Secretary of Labor. In addition, contractors shall be required to pay wages not less than once a week. The recipient shall place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation and the
award of a contract shall be conditioned upon the acceptance of the wage determination. The recipient shall report all suspected or reported violations to the Federal awarding agency.

**Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333)**

Where applicable, all contracts awarded by recipients in excess of $2000 for construction contracts and in excess of $2500 for other contracts that involve the employment of mechanics or laborers shall include a provision for compliance with Sections 102 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), as supplemented by Department of Labor regulations (29 CFR part 5). Under Section 102 of the Act, each contractor shall be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than 1 1/2 times the basic rate of pay for all hours worked in excess of 40 hours in the work week. Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

**Rights to Inventions Made Under a Contract or Agreement**

Contracts or agreements for the performance of experimental, developmental, or research work shall provide for the rights of the Federal Government and the recipient in any resulting invention in accordance with 37 CFR part 401, "Rights to Inventions made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

**Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as amended**

Contracts and subgrants of amounts in excess of $100,000 shall contain a provision that requires the recipient to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.). Violations shall be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).


Contractors who apply or bid for an award of $100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient.

**Debarment and Suspension (E.O.s 12549 and 12689)**

No contract shall be made to parties listed on the General Services Administration's List of Parties Excluded from Federal Procurement or Nonprocurement Programs in accordance with E.O.s 12549 and 12689, "Debarment and Suspension." This list contains the names of parties debarred, suspended, or otherwise excluded by agencies, and contracts declared ineligible under statutory or regulatory authority other than E.O. 12549. Contractors with awards that exceed the small purchase threshold shall provide the required certification regarding its exclusion status and that of its principal employees.
Access to Records (OMB Circular A-110, .48(d))

All negotiated contracts (except those for less than the small purchase threshold) awarded by recipients shall include a provision to the effect that the recipient, the Federal awarding agency, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the contractor which are directly pertinent to a specific program for the purpose of making audits, examination, excerpts and transcriptions.

31. Security Badging

All costs and time associated with obtaining a University security badge for Contractor employees working on campus shall be borne by the Contractor.
INSURANCE REQUIREMENTS (A)

Construction Purchase Order Insurance Requirements
University of Colorado Denver

For purposes of this supplement “Contractor” as used herein shall mean, as appropriate to the Contract form being used, Contractor, Standing Order Contractor or Construction Manager/General Contractor.

The Contractor shall obtain and maintain, at its own expense and for the duration of the contract including any warranty periods under the Contract are satisfied, the insurance coverages set forth below.

By requiring such insurance, the Principal Representative shall not be deemed or construed to have assessed the risk that may be applicable to the Contractor its agents, representatives, employees or subcontractors under this contract. The insurance requirements herein for this Contract in no way limit the indemnity covenants contained in the Contract. The Principal Representative in no way warrants that the limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, its agents, representatives, employees, or subcontractors. The Contractor shall assess its own risks and if it deems appropriate and/or prudent, maintain higher limits and/or broader coverages. The Contractor is not relieved of any liability or other obligations assumed or pursuant to the Contract by reason of its failure to obtain or maintain insurance in sufficient amounts, duration, or types.

COVERAGES AND LIMITS OF INSURANCE - Contractor shall provide coverage with limits of liability not less than those stated below.

1. Commercial General Liability – ISO CG 0001 or equivalent. Coverage to include:
   • Premises and Operations
   • Explosions, Collapse and Underground Hazards
   • Personal / Advertising Injury
   • Products / Completed Operations
   • Liability assumed under an Insured Contract (including defense costs assumed under contract)
   • Independent Contractors
   • Additional Insured—Owners, Lessees or Contractors Endorsement, ISO Form 2010 (2004 Edition or equivalent)
   • Additional Insured—Owners, Lessees or Contractors Endorsement (Completed Operations), ISO CG 2037 (7/2004 Edition or equivalent)
   • The policy shall be endorsed to include the following additional insured language on the Additional Insured Endorsements specified above: “The Regents of the University of Colorado, a Body Corporate, named as an additional insured with respect to liability and defense of suits arising out of the activities performed by, or on behalf of the Contractor, including completed operations”.

Page 1 of 7
• Commercial General Liability Completed Operations policies must be kept in effect for up to three (3) years after completion of the project.

<table>
<thead>
<tr>
<th>Liability Limits</th>
<th>General Aggregate</th>
<th>Products/Completed Operation Aggregate</th>
<th>Each Occurrence</th>
<th>Personal/Advertising Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary General Liability</td>
<td>$2,000,000</td>
<td>$2,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

The following exclusionary endorsements are prohibited in the CGL policy:

1. Damage to work performed by subcontract/vendor (CG 22-94 or similar);
2. Contractual liability coverage exclusion modifying or deleting the definition of an “insured contract”;
3. If applicable to the work to be performed: Residential or multi-family;
4. If applicable to the work to be performed: Exterior insulation finish systems;
5. If applicable to the work to be performed: Subsidence or earth movement.

2. **Automobile Liability**

Bodily Injury and Property Damage for any owned, hired, and non-owned vehicles used in the performance of this contract

**Minimum Limits:**

Bodily Injury/Property Damage (Each Accident) $ 1,000,000

3. **Workers Compensation**

• Statutory Benefits (Coverage A)
• Employers Liability (Coverage B)

  a. Policy shall contain a waiver of subrogation in favor of the Principal Representative.
  b. This requirement shall not apply when a contractor or subcontractor is exempt under Colorado Workers’ Compensation Act., AND when such contractor or subcontractor executes the appropriate sole proprietor waiver form.

**Minimum Limits:**

Coverage A (Workers’ Compensation) Statutory
Coverage B (Employers Liability)
Each accident $ 100,000
Disease each employee $ 100,000
Disease policy limit $ 500,000

4. **Contractors Pollution Liability**

• Coverage shall apply to sudden and gradual pollution conditions resulting from the escape of release of smoke, vapors, fumes, acids, alkalis, toxic chemicals, liquids, or
gases, natural gas, waste materials, or other irritants, contaminants, or pollutants (including asbestos). Policy shall cover the Contractor’s completed operations.

- If the coverage is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this Contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning from the time that work under this contract is completed.

- The policy shall be endorsed to include the following as Additional Insureds: The Regents of the University of Colorado, a Body Corporate, named as an additional insured with respect to liability and defense of suits arising out of the activities performed by, or on behalf of the Construction Manager, including completed operations.

- Endorsements CA9948 and MCS-90 are required on the Automobile Liability Coverage if the Contractor is transporting any type of hazardous materials.

- Contractors Pollution Liability policies must be kept in effect for up to three (3) years after completion of the project.

Minimum Limits:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Loss</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Aggregate</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

5. **Professional Liability (Errors and Omissions)**

*(This Professional Liability requirement applies only to Design/Build Projects.)*

- The Contractor shall maintain Errors and Omissions Liability covering negligent acts, errors and/or omissions, including design errors of the Contractor for damage sustained by reason of or in the course of operations under this Contract. The policy/coverages shall be amended to include the following:

  Amendment of any Contractual Liability Exclusion to state: “This exclusion does not apply to any liability of others which you assume under a written contract provided such liability is caused by your negligent acts.”

- In the event that any professional liability insurance required by this Contract is written on a claims-made basis, Contractor warrants that any retroactive date under the policy shall precede the effective date of this Contract; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning at the time work under this Contract is completed.

- Policy shall contain a waiver of subrogation against The Regents of the University of Colorado, a Body Corporate.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrongful Act</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>General Aggregate</td>
<td>$2,000,000</td>
</tr>
</tbody>
</table>
6. **Builder’s Risk/ Installation Floater**

For projects of $100,000 or more or otherwise provided or instructed by the Principal Representative, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the project is located, Builder’s Risk Insurance in the amount of the initial contract amount as well as subsequent modifications for the entire project at the site on a replacement cost basis without optional deductibles. This coverage is required for new buildings or additions to existing buildings and for materials and equipment to be installed in existing structures.

- Covered Cause of Loss: Special Form
- Include Theft and Vandalism
- Labor costs to repair damaged work
- Shall be written for 100% of the completed value (replacement cost basis)
- Deductible maximum is $50,000.00
- Waiver of Subrogation is to apply
- The Regents of the University of Colorado, a body corporate, shall be added as Additional Named Insured on Builders Risk.

1. Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.

2. The Policy shall be maintained, unless otherwise provided in the contract documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made or until no person or entity other than the Principal Representative has insurable interest in the property to be covered, whichever is later.

3. The Builder’s Risk insurance shall include interests of the Principal Representative, and if applicable, affiliated or associated entities, the General Contractor, subcontractors and sub-tier contractors in the project.

4. Builders’ Risk Coverage shall be on a Special Covered Cause of Loss Form and shall include theft, vandalism, malicious mischief, collapse, false-work, temporary buildings and debris removal including demolition, increased cost of construction, architect’s fees and expenses, flood (including water damage), earthquake, and if applicable, all below and above ground structures, piping, foundations including underground water and sewer mains, piling including the ground on which the structure rests and excavation, backfilling, filling, and grading. Equipment Breakdown Coverage (a.k.a. Boiler & Machinery) shall be included as required by the Contract Documents or by law, which shall specifically cover insured equipment during installation and testing (including hot testing, where applicable). Other coverages may be required if provided in contract documents.

5. The Builders’ Risk shall be written for 100% of the completed value (replacement cost basis) of the work being performed. The Builders’ Risk shall include the following provisions:
   a. Replacement Cost Basis - including modification of the valuation clause to cover all costs needed to repair the structure or work (including overhead and profits) and will
pay based on the values figured at the time of rebuilding or repairing, not at the time of loss.

b. Modify or delete exclusion pertaining to damage to interior of building caused by an
perils insured against are covered; also provide coverage for water damage.

Note, if the addition, or renovation is to an existing building, The Principal
Representative requires that the Contractor provide as an option to include the existing
building into the Builders’ Risk Policy. The Principal Representative shall provide the
replacement cost value of the existing building.

6. At the option of the Principal Representative, the Principal Representative may include Soft
Costs (including Loss of Use)/Delay in Opening Endorsement under the builder’s risk
policy. The Principal Representative agrees to provide the necessary exposure base
information for quotation by the Builder’s Risk carrier. The Principal Representative
agrees to pay the premium associated with the Soft Costs coverage, the Principal
Representative decides to purchase this coverage.

7. The Builders’ Risk Policy shall specifically permit occupancy of the building during
construction. Partial occupancy or use of the work shall not commence until the insurance
company or companies providing insurance have consented to such partial occupancy or
use. The Principal Representative and Contractor shall take reasonable steps to obtain
consent of the insurance company or companies and delete any provisions with regard to
restrictions within any Occupancy Clauses within the Builders’ Risk Policy. The Builders’
Risk Policy shall remain in force until acceptance of the project by the Principal
Representative.

8. The deductible shall not exceed $50,000 and shall be the responsibility of the Contractor
except for losses such as flood (not water damage), earthquake, windstorm, tsunami,
volcano, etc. Losses in excess of $50,000 insured shall be adjusted in conjunction with the
Principal Representative. Any insurance payments/proceeds shall be made payable to the
Principal Representative subject to requirements of any applicable mortgagee clause. The
Contractor shall pay subcontractors their just shares of insurance proceeds received by the
Contractor, and by appropriate agreements, written where legally required for validity, shall
require subcontractors to make payments to their sub-subcontractors in similar manner.

The Principal Representative shall have the authority to adjust and settle any losses in
excess of $50,000 with insurers unless one of the parties in interest shall object in writing
within five days after occurrence of loss to the Principal Representative exercise of this
power. It is expressly agreed that nothing in this section shall be subject to arbitration and
any references to arbitration are expressly deleted.

9. The Contractor is responsible for providing 45 days’ notice of cancellation to the Principal
Representative. The policy shall contain all generally applicable conditions, definitions,
exclusions and endorsements related to the Project.

If the Contractor does not intend to purchase such Builder’s Risk Insurance required by the
Contract and with all of the coverages in the amount described above, the Contractor shall
so inform the Principal Representative as stated in writing prior to commencement of the
work. The Principal Representative may then affect insurance that will protect the interests
of the Principal Representative, the General Contractor, Subcontractors and sub-tier
contractors in the project. Coverages applying shall be the same as stated above including
other coverages that may be required by the Principal Representative. The cost shall be
charged to the Contractor. Coverage shall be written for 100% of the completed value of the work being performed, with a deductible not to exceed $50,000 per occurrence for most projects. All deductibles will be assumed by the Contractor. Waiver of Subrogation is to apply against all parties named as insureds, but only to the extent the loss is covered, and Beneficial Occupancy Endorsements are to apply. If the Principal Representative is damaged by the failure or neglect of the Contractor to purchase or maintain insurance as described above, without so notifying the Principal Representative, then the Contractor shall bear all reasonable costs properly attributable thereto.

ADDITIONAL INSURANCE REQUIREMENTS

1. All insurers must be licensed or approved to do business within the State of Colorado, and unless otherwise specified, all policies must be written on a per occurrence basis.
2. Contractor’s insurance carrier should possess a minimum A.M. Best’s Insurance Guide rating of A- VI.
3. On insurance policies where the Principal Representative are named as additional insureds, the Principal Representative shall be additional insureds to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this Contract.
4. Contractor shall furnish the Principal Representative with certificates of insurance (ACORD form or equivalent approved by the Principal Representative) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and any required endorsements are to be received and approved by the Principal Representative before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of contract.
5. Upon request by the Principal Representative, Contractor must provide a copy of the actual insurance policy effecting coverage(s) required by the contract.
6. The Contractor’s insurance coverage shall be primary insurance and non-contributory with respect to all other available resources.
7. The Contractor shall advise the Principal Representative in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limit. At their own expense, the Contractor will reinstate the aggregate limits to comply with the minimum requirements and shall furnish to the Principal Representative a new certificate of insurance showing such coverage is in force.
8. Provide a minimum of thirty (30) days advance written notice to the Principal Representative for cancellation, non-renewal, or material changes to policies required under the Contract (45 days for builders’ risk coverage.

Failure of the Contractor to fully comply with these requirements during the term of the Contract may be considered a material breach of contract and may be cause for immediate termination of
the Contract at the option of the Principal Representative. The Principal Representative reserves the right to negotiate additional specific insurance requirements at the time of the contract award.

**Subcontractors**
Contractor’s certificate(s) shall include all subcontractors as additional insureds under its policies or subcontractors shall maintain separate insurance as determined by the Contractor, however, subcontractor's limits of liability shall not be less than $1,000,000 per occurrence / $2,000,000 aggregate.

**Non-Waiver**
The parties hereto understand and agree that The Principal Representative is relying on, and does not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, et seq., as from time to time amended, or otherwise available to the Principal Representative or its officers, employees, agents, and volunteers.

**Mutual Cooperation**
The Principal Representative and Contractor shall cooperate with each other in the collection of any insurance proceeds which may be payable in the event of any loss, including the execution and delivery of any proof of loss or other actions required to effect recovery.

**Revised March 12, 2012 MB**
NEW AUTOMATED SERVICES FOR AND ABOUT BUSINESSES

The Colorado Department of Revenue Sales Tax Information System provides the following automated services:
* Colorado Sales Tax Rates - find specific city, county and special district rates.
* Verification of Sales Tax License Exemption Numbers - determine whether a Colorado sales tax license or exemption certificate is valid.
* Tax Rates by Account Number - find sales tax rates and locations for specific sales tax accounts.

These services make it possible for taxpayers to help themselves to information 24 hours a day - without requiring the assistance of a customer service representative. In this way, more complicated or confidential tax information inquiries can be reserved for speaking to a live agent.

Listen and look for these services on the department's business tax information phone line at 303-238-FAST (3278) for specific account information, 303-238-SERV (7378) for general information or the DOR Web site at www.taxcolorado.com

Web users can try the new system online at www.taxview.state.co.us We are interested in your comments about the system. You can send us an e-mail with your comments through our Department of Revenue Web site.
SALES TAX EXEMPTION CERTIFICATE
MULTI-JURISDICTION

Name of Firm (Saler):
Regents of University of Colorado

Address:
1800 Grant Street, Suite 600
Denver, CO 80203

City of Sale:
Denver

State of Sale:
CO

ZIP Code:
80203

□ WHOLESALE
□ RETAILER
□ MANUFACTURER
□ LESSOR (See date on reverse side)
□ CHARITABLE OR RELIGIOUS

□ POLITICAL SUBDIVISION OR GOVERNMENTAL AGENCY
□ OTHER (Specify):

1) and is registered with the below listed states and cities within which your firm would deliver purchases to us which are for resale or lease by us in the normal course of our business which is:

2) that such purchases are exempt from payment of sales or use tax in such states and cities because our buyer is:

□ CHARITABLE OR RELIGIOUS

□ POLITICAL SUBDIVISION OR GOVERNMENTAL AGENCY
□ OTHERWISE EXEMPT BY STATUTE (SPECIFY):

If the list of states and cities is more than six (6), attach a list to this certificate.

City or State:
Aurora

State Registration or ID Number:
98-00799-0000

City or State:
Colorado

State Registration or ID Number:
98-02915

City or State:

State Registration or ID Number:

If the list of states and cities is more than six (6), attach a list to this certificate.

I further certify that if any property so purchased tax free is used or consumed by the firm as to make it subject to a Sales or Use Tax we will pay the tax due direct to the proper taxing authority when state law so provides or inform the seller for added tax billing. This certificate shall be part of each order which we may hereafter give to you, unless otherwise specified, and shall be valid until cancelled by us in writing or revoked by the city or state.

General description of products to be purchased from the seller:

Under penalties of perjury, I swear or affirm that the information on this form is true and correct as to every material matter.

Authorized Signature (Owner, Partner or Corporate Officer):

This Associate Vice President and University Controller:

Date: 7/25/2008
March 12, 2001

Wayne F. Henderson
Vice Chancellor for Administration and Finance
University of Colorado Health Sciences Center
Fitzsimons, Building 500, Room C1003
P.O. Box 6508
Aurora, Colorado 80045-0508

RE: Letter of Commitment

Dear Mr. Henderson:

I am in receipt of your letter dated February 27, 2001, requesting that I issue a letter of commitment to the University of Colorado Health Sciences Center ("UCHSC") pursuant to City Code Section 130-63(c). It is my understanding that UCHSC is part and parcel of the University of Colorado, a public institution of higher education of the State of Colorado, § 23-20-101, et seq., C.R.S. You have asked for some assurance that UCHSC is exempt from the payment of City sales and use tax, as well as the employer portion of the City occupational privilege tax.

City Code Section 130-157(1) exempts all sales of tangible personal property and taxable services to the various political subdivisions of this state from imposition of City sales tax. Identical exemptions exist in both the City Use Tax ordinance (City Code § 130-198(5)) and the City Employer Occupational Privilege Tax ordinance (City Code § 130-405(1)). Accordingly, UCHSC falls squarely within each of these three exemptions.

It should be noted, however, that these exemptions do not extend to the collection of City tax. For instance, UCHSC must collect, report, and remit City sales tax on any retail sale of tangible personal property or taxable services it makes to a non-exempt third party. City Code § 130-160. Likewise, UCHSC
must also collect, report, and remit the employee portion of the City occupational privilege tax for each person it employs within the City for any period of time within a calendar month sufficient to receive no less than $250.00 as compensation for such employment. City Code § 130-464.

With respect to the deposit and ultimate payment of City use tax on construction materials, it is the longstanding policy of the City that the party who contracts for and directs and controls the construction of building improvements is liable for such tax. See Fifteenth Street Investment Co. v. People, 102 Colo. 571, 81 P.2d 764 (1938). Under the circumstances described in your request, it is UCHSC, and not its contractors, upon whom sole liability for the payment of City use tax would rest. Because UCHSC is an exempt entity, no use tax is due and owing on the purchase and subsequent use of construction materials for the development of UCHSC's property at the Fitzsimons site.

With regard to your additional requests, the City has no objection if UCHSC's contractors wish to use this letter to present to City building officials and third-party retailers as evidence of UCHSC’s tax exemption. As for any future revocation of this letter, unless the status of UCHSC as a political subdivision changes, the various City tax exemptions which UCHSC is entitled to claim cannot be lawfully repealed without the prior approval of the City's voters. See Colo. Const. Art. X, § 20(4)(a). Therefore, the City believes UCHSC will be adequately informed in the event that the City decides to seek approval for any change in its tax laws that would impact UCHSC’s tax-exempt status.

Very truly yours,

[Signature]
John Gross
Director of Finance
November 5, 1999

University of Colorado Procurement Service Center
Fitzsimmons Building 500 Rm. B4325
Mail Stop F 719
P.O. Box 6508
Aurora, CO 80045

Ladies/Gentlemen:

The University of Colorado Procurement Service Center is exempt from the Denver sales tax per Sec. 53-26 (1) of the City Retail Sales Tax Article:

Sec. 53-26(1) Exemptions.

There shall be exempt from taxation under the provisions of this Article the following:
(1) All sales to the United States Government, to the State, its departments and institutions and the political subdivisions thereof, only when purchased in their governmental capacities.

To qualify for the exemption, purchases must be billed direct to the organization, and payment made from funds of the organization.

The exemption does not extend to construction contractors who may perform contracts for you; they are the consumer of all property purchased and used in the performance or contracts for others. Nor does the exemption apply to purchases by employees or members for their own personal use.

You may reproduce this letter to furnish to suppliers as needed.

Sincerely,

Scott Sprague, Audit Manager
Tax Compliance Audit Section
(303) 640-3484
Michael J. Barden  
University of Colorado at Denver and Health Sciences Center (UCDHSC)  
Building 500, Mail Stop F418  
P.O. Box 6508  
Aurora CO 80045  

April 7, 2006  

Dear Mr. Barden:  

This is in response to your letter of March 1, 2006, to Bruce Nelson of the Department of Revenue regarding sales tax exemption from county and special district sales taxes for UCDHSC construction projects at the Fitzsimons campus. Mr. Nelson has left the Department, so I am responding to your inquiry.  

In regards to Adams County sales and use tax, the sales tax is collected by the Department of Revenue, not the city of Aurora. Use tax on building materials is collected by the county when issuing building permits. Under 29-2-105(d), 39-26-708(1)(a) and 39-26-708(2)(a), C.R.S., UCDHSC and its contractors and sub-contractors are exempt from county sales and use tax on construction and building materials for State/UCDHSC owned real property.  

In regards to special district sales and use taxes, UCDHSC and its contractors and sub-contractors are exempt from sales and use tax pursuant to the exemptions granted in 39-26-708(1)(a) and 39-26-708(2)(a), C.R.S., for the Regional Transportation District under 32-9-119(2)(c)(II), C.R.S., for the Scientific and Cultural District under 32-13-107(2), C.R.S., and for the Metropolitan Football Stadium District under 32-15-110(2)(a), C.R.S.  

Additionally, for construction projects in the City and County of Denver, UCDHSC and its contractors and sub-contractors are exempt from the aforementioned special district sales and use taxes, as well as state sales and use tax.  

Should you have additional questions regarding these matters, feel free to contact me.  

Respectfully,  

Steve Asbell  
Taxpayer Service Policy Group  
Colorado Dept of Revenue  
Ph:303.866.3889 email: sasbell@spike.dor.state.co.us
CONTRACTOR APPLICATION FOR EXEMPTION CERTIFICATE
Pursuant to Statute
Section 39-26.708(1)(a)(XIX)

The exemption certificate for which you are applying must be used only for the purpose of purchasing construction and building materials for the exempt project described below. This exemption does not include or apply to the purchase or rental of equipment, supplies, and materials which are purchased, rented, or consumed by the contractor and which do not become a part of the structure, highway, road, street, or other public works owned and used by the exempt organization.

Any unauthorized use of the exemption certificate will result in revocation of your exemption certificate and other penalties provided by law.

A separate certificate is required for each contract.

Subcontractors will not be issued Certificates of Exemption by the Department of Revenue. It is the responsibility of the prime contractor to issue certificates to each of the subcontractors. (See reverse side.)

SEND COMPLETED FORMS TO: COLORADO DEPARTMENT OF REVENUE, DENVER, CO 80261
FAILURE TO ACCURATELY COMPLETE ALL BOXES WILL CAUSE THE APPLICATION TO BE DENIED.

<table>
<thead>
<tr>
<th>Contractor/Account No. (Leave blank if filing for the first time)</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>89 -</td>
<td>0170-750 (999) $0.00</td>
</tr>
</tbody>
</table>

CONTRACTOR INFORMATION

<table>
<thead>
<tr>
<th>Trade name/DBA:</th>
<th>Owner, partner, or corporate name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mailing address (City, State, Zip):</td>
<td>Contact Person</td>
</tr>
<tr>
<td>E-Mail address:</td>
<td>Federal Employer's Identification Number:</td>
</tr>
<tr>
<td>Fax number: ( )</td>
<td>Bid amount for your contract: $</td>
</tr>
<tr>
<td>Business telephone number: ( )</td>
<td>Colorado withholding tax account number:</td>
</tr>
</tbody>
</table>

EXEMPTION INFORMATION

Copies of contract or agreement pages, identifying the contracting parties, bid amount, type of work, and signatures of contracting parties MUST be attached.

<table>
<thead>
<tr>
<th>Name of exempt organization (as shown on contract):</th>
<th>Exempt organization's number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address of exempt organization (City, State, Zip):</td>
<td>98 -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Principal contact at exempt organization:</th>
<th>Principal contact's telephone number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical location of project site (give actual address when applicable and Cities and/or County (ies) where project is located)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scheduled construction start date:</th>
<th>Estimated completion date:</th>
</tr>
</thead>
</table>

I declare under penalty of perjury in the second degree that the statements made in this application are true and complete to the best of my knowledge.

<table>
<thead>
<tr>
<th>Signature of the business owner, partner or corporate officer:</th>
<th>Title of corporate officer:</th>
<th>Date:</th>
</tr>
</thead>
</table>

DO NOT WRITE BELOW THIS LINE
Special Notice

Contractors who have completed this application in the past, please note the following changes in procedure:

The Department will no longer issue individual Certificates of exemption to subcontractors. Only prime contractors will receive a Contractor's Exemption Certificate on exempt projects.

Upon receipt of the Certificate, the prime contractor should make a copy for each subcontractor involved in the project and complete it by filling in the subcontractor's name and address and signing it.

The original Certificate should always be retained by the prime contractor. Copies of all Certificates that the prime contractor issued to subcontractors should be kept at the prime contractor's place of business for a minimum of three years and be available for inspection in the event of an audit.

Once an 89# has been assigned to you, please use the next five numbers following it for any applications submitted for future projects. This should be your permanent number. For instance, if you were assigned 89-12345-0001, every application submitted thereafter should contain 89-12345 on the application. The succeeding numbers will be issued by the Department of Revenue. **DO NOT** enter what you believe to be the next in sequence as this may delay processing of your application.
SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by University.
4. Work under separate contracts.
5. University-furnished and installed products.
7. Access to site.
8. Coordination with occupants.
10. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 35 46 “Indoor Air Quality Procedures” for requirements and procedures related to maintaining air quality in adjacent occupied spaces and buildings.
2. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of University's facilities and for the provision of temporary construction barriers and dust partitions.

1.2 PROJECT INFORMATION

A. Project Identification: 17-289575

Project Location: University of Colorado Denver, Anschutz Medical Campus, 1945 N. Wheeling Street, Aurora, CO 80045

Principal Representation: University of Colorado Denver.

University's Representative: Robert Holzwarth

B. Architect/Engineer: Bennett Wagner Grody Architects

C. Architect/Engineer's Consultants: See Project Directory for team information

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and, in summary, briefly consists of the following:
The project will renovate a total of approximately 1,200 sf of space in Building 500, Cancer Center on the 6th Floor. This work will involve removal of two walls and 3 doors to provide an open office area. Furniture design will be provided by others. The construction will include updating mechanical and electrical work to accommodate the open office, ceiling replacement as needed, patch and paint at walls, and carpet patching.

The second area includes five existing offices in the Cancer Center. No construction by the General Contractor is required. Five data outlets need installation/activation. This Work will be completed by the University. The spaces are single offices currently. The work includes adding or reuse of furniture to accommodate two workstations in each of the five offices.

1.4 WORK BY UNIVERSITY

A. General: Cooperate fully with University so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by University. Coordinate the Work of this Contract with work performed by University.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 UNIVERSITY-FURNISHED, CONTRACTOR-INSTALLED PRODUCTS

A. The University may furnish certain items delivered to the jobsite. Contractor will receive, unload, move, set in position, anchor and connect such items and put them into operating condition.

B. The Contractor will be responsible for coordinating their work to accommodate these items including, but not limited to, physical space fit, utility connections and rough-in, power wiring and electrical characteristics.

C. Include in Project scheduling the latest times when information for such items is required and so notify the University in writing.

D. Cooperate with University in scheduling the delivery of these items and be responsible for accommodating their storage and protection in the building and their replacement or repair due to damage as a result of Contractor’s operations.

1.7 ACCESS TO SITE

A. General: Contractor shall have limited and restricted use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Adjust means and methods of construction based on site limits and restrictions.
2. Locate staging areas only where permitted by University.
3. As part of this Project, replace damaged lawns, sprinkler systems, sidewalks and any other existing site improvements within staging area and access ways.
C. Construction Access and Travel:

1. Use only those entrances, exits, and travel ways on campus roads and within the building designated by University. Contractor's personnel are not permitted in non-designated areas of University's existing facilities. Use only designated travel ways for transporting demolition materials, new construction materials, tools and equipment.

2. Use of other than designated travel ways on campus roads and within existing buildings requires a minimum of 20 business days prior approval by University.
   a. Request variations to traffic flow including temporary fire lane, parking lot, sidewalk and road closures, regulatory signage, and traffic control devices in accordance with University “Procedure for Approval of Regulatory Signage, Traffic Control Devices and for Street Closures at the Anschutz Medical Campus” and “AMC Campus Street and Parking Lot Closure Request” available through University Project Manager.

3. Access to the site will be as permitted by the University. Prearrange delivery and use of cranes, heavy trucks and other heavy equipment at least 72 hours prior to need through the University’s Project Manager and University Police.

4. Maintain access to fire lanes and campus operations at all times. Provide flag personnel during the ingress or egress of large equipment.
   a. When fire lanes and/or access way must be temporarily disrupted notify University Police and University Parking and Transportation at least 20 business days in advance and reconfirm 72 hours in advance through the University’s Project Manager.

5. Arrange for and obtain all necessary permits from City of Aurora for any disruption to or temporary closures of public city streets. Coordinate procurement of permits with Anschutz Medical Campus Liaison and University Project Manager.

D. Construction Parking:

1. General: Contractor must pay for all parking and, if available, may be assigned parking spaces in designated contractor parking lots. Parking in lots designated for visitors and patients is not permitted. Make arrangements for designated spaces and payment for long term parking with University Parking Services through the University Project Manager.

2. Provide temporary parking or use designated areas of University’s existing parking areas as applicable to the Project and in accordance with the following:
   a. All parking on University property, including parking on University owned streets, is under the exclusive control and authority of University Parking and Transportation Services. Direct policy question to the department at (303) 724-2555.
   b. There is no free parking on campus. Displacement or use of existing parking spaces by Contractor, either for parking or for staging, is a Contractor cost.
   c. Use of existing parking spaces or other areas outside of Contractor’s staging area must be approved in advance by University Parking and Transportation Services.
   d. University Parking and Transportation Services may require and issue parking permits through the University Project Manager. Permits must be displayed and visible at all times while parked on the campus. Failure to display a permit will result in citations being written and possible removal of the vehicle from University property.
   e. Keep all designated parking areas clean and free of litter and debris. University reserves the right to direct Contractor to clean areas not kept clean and orderly.
   f. University Parking and Transportation Services may change parking assignments as deemed necessary, restrict the use of any space(s) or lot(s) at any time, and determine the hours of control and mode of operations for any parking area at any time. University Parking and Transportation Services may deny or revoke parking privileges to any person when deemed necessary and/or considered to be in the best interests of the University.
3. Parking on University property is at the Contractor’s own risk. The University and any entity
affiliated with it are not responsible for fire, theft, and damage to or loss of contractor’s or
subcontractor’s vehicle or any article left therein. Only a license is granted to the user and no
bailment is created.

E. Condition of Existing Building: Maintain portions of existing building affected by construction
operations in a weathertight condition throughout construction period. Repair damage caused by
construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. University may occupy site and both existing and adjacent building(s) during entire construction period.
Cooperate with University during construction and sequence operations to minimize conflicts and
facilitate University usage. Perform the Work so as not to interfere with University's day-to-day
operations.

1. Maintain existing exits from existing and adjacent building, unless otherwise indicated.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
Do not close or obstruct walkways, corridors, or other occupied or used facilities without written
permission from University and approval of authorities having jurisdiction.
3. Limit construction operations to those methods and procedures which will not adversely and
unduly affect the working environment of University’s occupied spaces, including noise, dust,
odors, air pollution, ambient discomfort, poor lighting, hazards and other undesirable effects and
conditions.
4. Coordinate with University Project Manager to schedule jack hammering or activities producing
dusty conditions, excessive fumes or odors during off-hours.
5. When work must be accomplished in areas containing existing furniture, upon a minimum of 3
business days notification of the University Project Manager, University will remove or relocate
existing furniture.
6. Provide not less than 72 hours' notice to University Project Manager of activities that will affect
University's operations. University Project Manager will coordinate with campus tenants.
   a. Refer to “Work Restrictions” Article of this Section for procedures and notification
      requirements related to utility interruptions.
7. Provide temporary barriers and partitions, or other means as required to protect occupants of
existing building and the general public from injury due to construction activities. Prevent the
spread of dust and dirt to adjacent occupied areas and building.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having
jurisdiction.
2. In planning and executing the Work, take into consideration the special needs of University patient
care, teaching and research settings, for example, supply of critical utilities, noise and dust control,
access to existing loading docks, occupied buildings, etc.

B. Normal Working Hours: Limit work to normal working hours of 7:00 a.m. to 6:00 p.m., Monday through
Friday.
1. Notify University Project Manager of all proposed work outside of normal working hours. Include dates, times, names and contact information for contractors and subcontractor performing the Work with notification. University Project Manager will notify, as appropriate, other University personnel and departments including, but not limited to, Building Maintenance and Operations (BMO) Directors, BMO assigned representative, Campus Police and Facilities Management.

C. Noise and Vibration: Coordinate operations that may result in high levels of noise and vibration, or other disruption to University occupancy with University.

1. Noise during Normal Working Hours: Identify potentially disruptive construction activities at weekly Progress Meeting and adjust active time of day to reduce significant impacts on occupants.
2. Noise outside Normal Working Hours: Schedule construction work or demolition work outside of normal working hours with University Project Manager at minimum of 72 hours in advance.
   a. The maximum permissible noise level is 75 decibels (dBA), measured at the adjacent property line.

D. Contractor Identification:

1. Supervisory staff for the primary contractor must obtain an identification badge at the University Anschutz Medical Center (AMC) Building 500. Submit the University Access Control Badge Application form through University Project Manager. Submitted forms shall be complete with all required information including a letter on company letterhead confirming employee status with company and stating whether the company completes background testing and/or drug screening. Contractor supervision must display badge on site during construction activities.

2. To the greatest extent possible, Contractor’s and subcontractor’s employees must wear a recognizable logo shirt or hardhat identifying them as members of the contractor’s work force.

E. Use of Existing Elevators: Use “freight” elevators only and protect finishes during transport. Restrict use exclusively to time required to move construction materials.

1. Do not block corridors, aisles, passageways or doors leading to elevator except as, and only to the extent approved by University Project Manager.

F. Keys: Submit written request to University Project Manager on University Key Request Form.

1. To the extent the need for keys is demonstrated and required to complete the Work, University Project Manager will issue keys to Contractor.
2. Contractor is responsible for all costs related to lost or non-returned keys.
3. Electrical, mechanical and sensitive research space may require University escort in lieu of issuing keys.

G. Dock Deliveries: Restrict use exclusively to time required to unload and move construction materials.

H. Existing Utility Interruptions: Do not interrupt water, sewer, plumbing, gas, steam, chilled water, oxygen, HVAC, electrical power, lighting, telephone and other related utilities serving facilities occupied by University without prior notice to and approval by the University. Coordinate and schedule interruptions in advance through the University Project Manager in strict conformance with University Utility Interruption/Outage Request Procedure.

1. Form of Notice: University Utility Interruption and Start-up Request form.
2. Time of Notice: Notice for major and minor outages as defined by the Utility Interruption/Outage Request Procedure is 8 business days for minor outages and 31 business days for major outages.
I. Fire Alarm and Fire Sprinkler Interruptions: When construction activities require interruption of fire alarm or fire sprinkler service, or when dust from construction activities is likely to cause accidental alarm, advise University Project Manager who will submit an interruption request.

1. Form of Notice: University Fire Alarm/Sprinkler Disable Request Form.
2. Time of Notice: Prior to noon on the day before the anticipated interruption.

J. Nonsmoking Campus: Smoking, chewing tobacco, and other related tobacco product use is not permitted at any location on campus or on any adjacent property.

K. University Policies Applying to All Contractors: Comply with University policies applying to contractors including drug policy, sexual harassment policy and tobacco free policy. Obtain copies of University policies from University Project Manager.

1. Controlled Substances: Use of tobacco products and other controlled substances on Project site and surrounding Campus is not permitted.

L. Designated Eating Areas: Restrict consumption of food on project site to designated eating areas as approved by University Project Manager.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
3. Words in the singular number include the plural and those in the plural include the singular.
4. Words of any gender include any other gender.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products may be identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00
PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes matrix of utility sources applicable to Project.

1.2 QUALITY ASSURANCE
   A. Comply with utility company and regulatory agency codes, standards, and guidelines for the provision of new or extension of existing utilities.

1.3 UTILITY SOURCE MATRIX
   A. The following matrix summarizes utility responsible for provision of utility service:
<table>
<thead>
<tr>
<th>Utility Sources</th>
<th>Developer</th>
<th>Note 1</th>
<th>Note 2</th>
<th>Note 3</th>
<th>Note 4</th>
<th>Note 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>Xcel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>Developer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wastewater</td>
<td>University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drainage</td>
<td>Developer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>Developer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Water</td>
<td>Developer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td>University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: University owns Trunk steam and chilled water from CUP to vault. They are feeding lines are owned by the building University TCH, UCH, in Tract.

Note 2: University owns Trunk electrical from switch gear to main switchgear.

Note 3: University owns Trunk telecom duct bank from main switch to manhole.

Note 4: Xcel has license agreement with University.

Note 5: Xcel has license agreement with University.

Developer owns cable from switch to building.

City of Aurora: University owns Trunk electrical from switchgear to manhole.


developer: Note 3: University owns Trunk telecom duct bank from main switch to manhole.

Developer owns cable from switch to building.

University owns Trunk steam and chilled water from CUP to vault.

Developer owns cable from switch to building.

City of Aurora: University owns Trunk electrical from switchgear to manhole.

University owns Trunk electrical from switchgear to manhole.

City of Aurora: University owns Trunk electrical from switchgear to manhole.

City of Aurora: University owns Trunk electrical from switchgear to manhole.

City of Aurora: University owns Trunk electrical from switchgear to manhole.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 18 00
SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
3. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or University that are not required in order to meet other Project requirements but may offer advantage to Contractor or University.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit each request for consideration in format and quantities specified in Section 01 33 00 “Submittal Procedures”. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A or Contractor-generated form with substantially the same information.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
   b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by University and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect/Engineer's Action: If necessary, Architect/Engineer in consultation with the University will request additional information or documentation for evaluation within seven calendar days of receipt of a request for substitution. Architect/Engineer in consultation with the University will notify Contractor of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order.

b. Use product specified if Architect/Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 calendar days prior to time required for preparation and review of related submittals.
1. Conditions: Architect/Engineer in consultation with the University will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record noncompliance with these requirements:

   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Requested substitution provides sustainable design characteristics that specified product provided.
   c. Substitution request is fully documented and properly submitted.
   d. Requested substitution will not adversely affect Contractor's construction schedule.
   e. Requested substitution has received necessary approvals of authorities having jurisdiction.
   f. Requested substitution is compatible with other portions of the Work.
   g. Requested substitution has been coordinated with other portions of the Work.
   h. Requested substitution provides specified warranty.
   i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00
SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

2. Contractor’s Agreement Design/Bid/Build, State Form SC-6.21 and The General Conditions of the Construction Contract Design/Bid/Build, State Form SC-6.23 for definitions and contractual requirements related to contract modification procedures.

1.2 DEFINITIONS

A. Change Order: A written order in compliance with the requirements of the Contract authorizing changes in the Work. For the purposes of this Section a Change Order and a Contract Amendment shall have the same meaning.

1.3 INFORMATIONAL SUBMITTALS

A. Contractor’s Authorized Signatory: Submit name of individual authorized to accept changes and responsible for informing others employed by Contractor of changes in the Work.

1.4 MINOR CHANGES IN THE WORK

A. Architect/Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.5 CHANGE ORDER BULLETIN

A. University-Initiated Change Order Bulletin: Architect/Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. It will also state the time period for which the request will remain valid.


2.  Work Change Order Bulletins issued by Architect/Engineer are not instructions either to stop work in progress or to execute the proposed change.
B. Contractor-Initiated Change Order Bulletin: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect/Engineer.

2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

1.6 CHANGE ORDER PROPOSAL

A. Change Order Proposal: In response to a University-Initiated Change Order Bulletin or accompanying a Contractor-Initiated Change Order Bulletin, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change described.

2. Labor Rates: Prior to submitting first Change Order Proposal, submit bare, unburdened hourly labor rates for all contractor and subcontractor labor categories; submit itemized breakdown of all applicable additional labor benefit costs to be added to the bare labor cost to arrive at the total burdened hourly labor cost.
3. Equipment Costs: Provide cost backup for all equipment clearly indicating equipment billing rates and sufficient to demonstrate, as determined by the University Project Manager, that proposed rates are competitive and reasonable in all cases. Submit completed Change Order Proposal Form within the requested timeframe. Include backup documentation to support calculations consistent with Contract provisions, including but not limited to, the following:

   a. Contractor and Subcontractor labor, material and equipment costs including:

      1) A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      2) Applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      3) Costs of labor and supervision directly attributable to the change and as permitted by the terms and conditions of the General Contract for Construction.

   b. Contractor and Subcontractor overhead and profit.
   c. Contractor’s bond cost.
   d. Justification for Change in Contract Time: An updated Contractor’s construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

4. Maintain detailed records of work completed. Provide complete information for evaluation of proposed changes and to substantiate proposed changes in Contract Sum or Contract Time.

1.7 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.
1.8 CHANGE ORDER PROCEDURES

A. Submit three signed copies of Change Order Proposal to Architect/Engineer for review.

1. University-Initiated Change Order Bulletins: University and Architect/Engineer will evaluate Contractor’s Change Order Proposal and either request additional information or suggest modifications. Based on this review and evaluation University will either accept or reject the proposal.

2. Contractor-Initiated Change Order Bulletins: Architect/Engineer will evaluate Contractor’s claim based on the terms and conditions of the Contractor Agreement and General Conditions of the Construction Contract, as applicable.

3. Architect/Engineer’s Action: When satisfied as to the accuracy and completeness of the Change Order Proposal, the Architect/Engineer will sign all three copies and forward to the University for consideration.

B. On University's approval of a Change Order Proposal, Architect/Engineer will prepare, sign and forward three copies of a Change Order, State Form SC-6.31 available from the website of the Office of the State Architect, for signature by the Contractor. Contractor then forwards all three copies of signed Change Order to the University for signature and distribution of fully executed copies to Architect/Engineer and Contractor for record.

C. Upon receipt of a fully executed Change Order, promptly perform the following:

1. Revise Schedule of Values on the Application for Payment Form by indicating each authorized Change Order as a separate line item and adjusting the Contract Sum as shown on the Change Order.
   a. University will not pay for changes to the Work until authorized by a Change Order signed by all parties.

2. Revise the Progress Schedule to reflect any change in the Contract Time.

3. Enter changes in the Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00
SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor’s construction schedule. Schedule of values report from cost-loaded Critical Path Method Schedule prepared in accordance with Section 01 32 00 “Construction Progress Documentation” may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

1) Construction Manager’s Fee.
2) Estimated Project General Conditions Costs.

2. Submit schedule of values and hold a conference with the Architect/Engineer and University Project Manager to finalize the schedule of values at earliest possible date, but no later than 10 business days before the date scheduled for submittal of initial Certificates and Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect/Engineer.
c. Architect/Engineer's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.

   a. Include separate line items under Contractor and principal subcontracts for LEED documentation, where applicable, and other Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not a direct cost of actual work-in-place shall be shown as separate line items in the schedule of values.

7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect/Engineer and paid for by University.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Pay Application and Schedule Review Meetings: Conduct in accordance with Section 01 31 00 “Project Management and Coordination.” Provide draft application for payment and draft schedule update reflecting work accomplished during previous pay period. Review progress achieved; discuss and resolve issues affecting the progress; and review critical activities to be accomplished during the following 90 calendar days.
   1. Jobsite Walk: When required, conduct a walk of the jobsite to confirm progress related to any activity in question.

C. Monthly Schedule Reporting: Upon conclusion of the Pay Application and Schedule Review Meeting, but not later than the 28th of the month, update the Construction Schedule and submit the Pay Application.
D. Payment Application Times: Submit Application for Payment to Architect/Engineer by the first day of the month and no more than five (5) business days prior thereto. The period covered by each Application for Payment is per the date indicated in the Application.

E. Payment Application Review: The Architect/Engineer shall, within five (5) business days after the receipt of each Certificate and Application for Payment, review the Project Application for Payment and either execute a Project Certificate for Payment to the University or notify the Contractor in writing of the reasons for withholding a Certificate.

1. All applications for payment, except the final application, and the payments there under, shall be subject to correction in the next application rendered following the discovery of any error.

F. Application for Payment Forms: Use State Form SBP-7.2 “Certification for Contractor Payment.”

G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect/Engineer will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under University-requested project acceleration.

H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site as approved in advance by the University Project Manager and items stored at an off-site location previously agreed upon in writing.

1. Provide certificate of insurance, evidence of transfer of title to University, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect/Engineer by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
PAYMENT PROCEDURES

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor’s construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. List of Contractor’s staff assignments.
7. List of Contractor’s principal consultants.
10. Initial progress report.

K. Application for Payment at Substantial Completion: After Architect/Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for University occupancy of designated portions of the Work.

L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:

1. All items on Pre-acceptance Checklist (State Form SBP-05) have been completed.
2. Notice of Acceptance (State Form SBP-6.27) has been issued.
3. Statements to support local sales tax refunds, if any submitted.
4. Notice of Contractor’s settlement has been published.
5. Evidence of completion of Project closeout requirements, including but not limited to:
   a. Submittal of Record Documents.
   b. Submittal of all Operation and Maintenance Manuals.
   c. Completion of all required demonstration and training.

6. Updated final statement, accounting for final changes to the Contract Sum.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when University took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00
SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Within 21 calendar days of Notice of Award submit, as complete as possible, a preliminary list to include all major subcontractors. Augment, complete and submit the final subcontractor list within 60 calendar days of Notice of Award, unless a longer duration is approved by the Architect/Engineer. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 14 calendar days after Notice to Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1.4 GENERAL COORDINATION PROCEDURES

A. General: Each entity involved in the performance of work for the entire Project shall cooperate in the overall coordination of the Work; promptly, when requested, furnish information concerning its portion of the Work; and respond promptly and reasonably to the decisions and requests of persons designated with coordination, supervision, administrative or similar authority.

1. University Standard Project Management Forms

a. Where applicable, obtain from the University Project Manager and use the following University Standard Forms:

   1) Preconstruction Agenda
   2) Change Order Log with Contingency Codes
   3) Access Control Badge Application Form
   4) Utility Interruption Request Form
   5) Utility Start-Up Request Form
   6) Fire Alarm/Sprinkler Disable Request Form
   7) Hot Work Permit Form
   8) Anschutz Medical Campus (AMC) Street and Parking Lot Closure Form
   9) Indoor Air Quality (IAQ) Planning Checklist
   10) Indoor Air Quality (IAQ) Inspection Checklist

2. Site Utilization:

a. In addition to the site utilization limitations and requirements indicated in Section 01 10 00 “Summary” and indicated by the Contract Documents; administer the allocation of available space equitably among entities needing access and space, so as to produce the best overall efficiency in the performance of the total work of the project. Schedule deliveries so as to minimize the space and time requirements for storage of materials and equipment on the site; but do not unduly risk delays in the work.

b. Concurrent with work of the Contractor, other contractors, suppliers, and the University personnel may be working in relatively close proximity. The Contractor is solely responsible for coordinating their work with that of other contractors and will make no claims for failure to do so.

3. Layout:

a. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships of the various elements and systems and their interfacing with other elements and systems. Establishment and coordination of these relationships is the exclusive responsibility of the Contractor. Do not scale the drawings. Lay out and arrange all elements to contribute to safety, efficiency and to carry the harmony of design throughout the Work. In case of conflict or undimensioned locations, verify required positioning with Architect/Engineer.

4. Substrate Examination:

a. The Installer of each element of the work must examine the conditions of the substrate to receive the work, dimensions and spaces adjacent, tolerances, interfacing with other elements and services, and the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper or timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
5. Large and Heavy Equipment:
   a. Contractor to coordinate with University Project Manager requirements to be maintained for the subsequent entry of large equipment units. Coordinate the movement of heavy items with shoring and bracing, so that the building structure will not be overloaded during the movement and installation.
   b. Where equipment or products to be installed on the roof are too heavy to be hand-carried, do not transport across roof deck; position by crane or other device so as to avoid overloading the roof deck.

B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections of the Specification that depend on each other for proper installation, connection, and operation.
   1. Contractor Communication with the University: Direct all communication with the University through the University Project Manager.
   2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   4. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for University and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

E. Coordination Of Submittals: Prior to transmittal to the Architect/Engineer, review shop and erection drawings, product data, and samples for compliance with Contract Documents and for coordination among work of all Sections of the Specifications. Coordination of submittals shall include, but not be limited to the following:
   1. Verification of field dimensions and clearances and relationship to available space and anchors.
   2. Verification of compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.
   3. Verification of motor voltages and control characteristics.
   4. Coordination of controls, interlocks, wiring of pneumatic switches, and relays.
   5. Coordination of wiring and control diagrams.
   6. Review of the effect of any changes on work of other Sections.
7. For any item to be installed in or on a finished surface, certify that applicable Contract Documents have been checked and that the item submitted is compatible with the surface finish on which it is to be installed.

8. Equipment and material submittals shall show sufficient data to indicate complete compliance with Contract Documents as follows:
   a. Proper sizes and capabilities.
   b. Ability to fit in the available space in a manner that will allow proper service.
   c. Construction methods, materials, and finishes.
   d. List of accessories.

F. Special Coordination Requirements for Mechanical and Electrical Work:

1. General: Provide necessary work and services required to coordinate the complete installation of heating, ventilating, and air conditioning (HVAC) equipment and systems; plumbing systems and fixtures; electrical equipment, fixtures, and systems; and other equipment or systems containing motors and controls or requiring connection to mechanical or electrical systems; all so that the various systems perform as indicated and are in harmony with other project Work.

2. Contract Drawings:
   a. Drawings are schematic in nature, and indicate in general how the various components are integrated with other parts of the building. Coordinate exact locations by job measurement, by verifying the requirements of other trades, and by review of Contract Documents.

3. Mechanical and Electrical Drawings indicate general routing of the various parts of the systems, but do not indicate all sizes, fittings, offsets, and runouts which are required. Coordinate correct sizes, fittings, offsets, and runouts required to fit systems into allocated spaces. Coordinate locations of all light fixtures, vents, and supply grilles to conform to the ceiling grid system or other modular finishes.

4. Coordinate installation of mechanical and electrical work in compliance with the following requirements:
   a. Install piping, ductwork and similar services straight and true, aligned with other work, close to walls and overhead structure, allowing for insulation, concealed (except where indicated as exposed) in occupied spaces, and out-of-the-way with maximum passageway and headroom remaining in each space.
   b. Install electrical work in a neat, organized manner with conduit and similar services in or parallel with building lines, and concealed unless indicated as exposed.
   c. For all work maintain maximum practical overhead clearance but not less than 6" above ceiling. Where exposed, maintain 7'-0" minimum clearance.
   d. Arrange all work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
   e. Provide space to permit removal of coils, tubes, fan shafts, filters, other parts which may require replacement.
   f. Locate operating and control equipment and devices for easy access. Furnish access panels where units are concealed by finishes and similar work.
   g. Integrate mechanical work in ceiling plenums with suspension system, light fixtures and other work, so that required performances of each will be achieved.
   h. Give the right-of-way to piping systems required to slope for drainage over other service lines and ductwork.
   i. Advise other trades of openings required in their work for accommodation of mechanical and electrical elements. Provide and place sleeves and anchors required in other work.
5. Access to Equipment: Except where located above accessible ceilings, provide access panels wherever access is required to concealed valves, controls, dampers, pull boxes and other devices requiring ongoing or periodic access.

a. Acceptable types of access panels are specified in Division 08.

b. Each trade is responsible for providing access panels needed for access to their equipment and coordinating installation with other Division 03, 04, 06 and 09 trades.

c. Coordinate requirements and obtain approval of locations from Architect/Engineer.

G. Compatibility of Systems:

1. Provide products and equipment which are compatible with other work requiring mechanical/electrical interface including electrical connections, control devices, water, drain and other piping connections. Verify electrical characteristics, fuel requirements and other interface requirements before ordering equipment and resolve conflicts that may arise.

2. Coordinate equipment, mechanical and electrical work in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED BY</th>
<th>MOUNTED BY</th>
<th>LOW VOLTAGE WIRED BY</th>
<th>POWER WIRED &amp; CONNECTED BY</th>
<th>LOW VOLTAGE CONTROL CONNECTED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment motors</td>
<td>I</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>--</td>
</tr>
<tr>
<td>Motor starters, contactors and overload heaters</td>
<td>MI</td>
<td>EI</td>
<td>EI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Fused and unfused disconnect switches</td>
<td>EI**</td>
<td>EI**</td>
<td>EI**</td>
<td>EI</td>
<td>--</td>
</tr>
<tr>
<td>Manual operating switches, speed switches, push-button stations and pilot lights</td>
<td>MI</td>
<td>EI</td>
<td>EI</td>
<td>EI</td>
<td>EI</td>
</tr>
<tr>
<td>Duct detectors</td>
<td>EI</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Control relays and transformers</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Thermostats, time switches*</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Temperature control panels</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Motor and solenoid valves, damper motors, PE and EP switches</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>--</td>
<td>MI</td>
</tr>
<tr>
<td>Refrigeration equipment, cooling tower and controls</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Electric meters</td>
<td>EI</td>
<td>EI</td>
<td>EI</td>
<td>EI</td>
<td>MI</td>
</tr>
<tr>
<td>Steam meters</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
</tr>
<tr>
<td>Chilled water meters,</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
</tr>
<tr>
<td>Water meters</td>
<td>MI***</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
<td>MI</td>
</tr>
</tbody>
</table>

I = Installer of equipment requiring electrical service

Modified per Addendum 2
EI = Electrical Installer  
MI = Mechanical Installer

* Motor driven units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract. However, if the control device does not conduct full load current, then the responsibility shall be that set forth in the above schedule. (Example: a 208 volt, 3-phase, 3-wire motor requires 120 volt control. Electrical Installer shall furnish a 120 volt circuit for control and 208 volt circuit for power and wire the power circuit. Mechanical Installer shall wire the control circuit.)

** Disconnects for AH units are factory mounted.

***Building Service meter provided by Civil. Any sub meter provided by MI. Coordinate meter requirements with utility for remote monitoring by 23 09 00 – Instrumentation and Controls.

H. Complete Systems:

1. It is the intent of the Contract Documents that all systems, including mechanical and electrical, be complete and functional to provide the intended or specified performance. Provide all incidental items and parts necessary to achieve this requirement.

2. Provide correctly sized power, utilities, piping, drains, services and their connections to equipment and systems requiring them, whether or not specific items are listed in the schedule under “Compatibility of Systems” paragraph in this Section.

I. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as University's property.

2. Establish recycling program at job site. Refer to Section 01 74 19 “Construction Waste Management and Disposal” for additional requirements.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple subcontractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect/Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings, where required, to adequately represent the work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.

   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.

   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Windows, Curtain Wall, and Exterior Wall Assembly Transition Work: Show all components of each adjacent wall or window system and all required compatible tie-ins between them including transition strips, flashings and sealants. Clearly identify each product, its configuration and its extent. Shop Drawings which only generically indicate adjacent construction and/or indicate “construction by others” will not be acceptable.
10. Review: Architect/Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect/Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect/Engineer will so inform Contractor, who shall make changes as directed and resubmit.

11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

   a. Architect/Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

      1) Architect/Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

      2) Digital Data Software Program: Drawings are available in Revit 16

      3) Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to University and Architect/Engineer.

C. Interference Resolution: Whenever job measurements and an analysis of the building coordination model, Drawings and Specifications indicate that the various systems cannot be installed without significant deviation from the intent of the Contract, prepare interference drawings as required to indicate conflict between the various systems and other components of the building such as beams, columns, and walls. Include plans, elevations, sections, and other details drawn to large scale as required to clearly define the interference and to indicate the Contractor's proposed solution. Submit interference drawings for review by the Architect prior to proceeding with work in the general areas of the conflict.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

   1. Architect/Engineer will return RFIs submitted to Architect/Engineer by other entities controlled by Contractor with no response.

   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect/Engineer.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.
   13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.


C. RFI Forms: Hard copy form or software-generated form with substantially the same content as indicated above, acceptable to Architect/Engineer.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect/Engineer's Action: Architect/Engineer will review each RFI, determine action required, and respond. Allow seven calendar days for Architect/Engineer's response for each RFI. RFIs received by Architect/Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect/Engineer's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect/Engineer's action may include a request for additional information, in which case Architect/Engineer's time for response will date from time of receipt of additional information.

3. Architect/Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Contractor-Initiated Change Order Bulletin and Proposal according to Section 01 26 00 "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect/Engineer in writing within seven calendar days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI number. Submit log weekly. Use CSI Log Form 13.2B or Contractor-generated form of substantially same content. Include the following:

   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect/Engineer.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect/Engineer's response was received.

F. On receipt of Architect/Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect/Engineer within seven calendar days if Contractor disagrees with response.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify University and Architect/Engineer of scheduled meeting dates and times a minimum of 4 business days prior to meeting.
   
a. Participants, including representatives of subcontractors and suppliers, shall be qualified, familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including University and Architect/Engineer, within three business days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time and site convenient to all parties, but not later than 14 calendar days after Notice to Proceed.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
   
a. Authorized representatives of University:
      1) University Project Manager.
      2) University Building Maintenance Operations (BMO) Representative.

b. Architect/Engineer and their consultants.

c. Contractor’s project manager and superintendent.

d. Major subcontractors and suppliers.

e. Other concerned parties shall attend the conference.

3. Agenda: Discuss items of significance that could affect progress, including the following:
   
a. Designation of key personnel and their duties.

b. Lines of communications.

c. List of major subcontractors and suppliers.

d. Tentative construction schedule.

1) Phasing.

2) Critical work sequencing and long-lead items.

3) Equipment deliveries and priorities.

e. Procedures and processing of:


2) RFI’s

3) Testing and inspecting.

4) Applications for Payment.

5) Submittals.

6) Preparation of record documents.

f. Use of the premises, existing building and adjacent buildings as applicable.

1) Work restrictions.

2) Working hours.

3) University's occupancy requirements.
4) Procedures for disruptions and shutdowns.
5) Construction parking and staging.
6) Construction route and site access.
7) Office, work, and storage areas.
8) Progress cleaning and housekeeping procedures.

g. Project coordination.
h. Distribution of the Contract Documents.
i. Temporary facilities and controls.
j. Indoor Air Quality Plan and Monitoring including procedures for moisture and mold control.
k. Construction waste management and recycling.
l. Safety.

1) Fire and Life Safety.
2) Health and Safety.

m. First aid.
n. Security.
o. Building Department.
p. Telecommunications.
q. Building Services.
r. Building Operations.
s. University Work Related Policies.
t. Contractor Contacts.
u. University Contacts.
v. University Process Forms.

1) Key Request Form.
2) Access Control Badge Application Form.
3) Utility Interruption Request Form.
4) Utility Start-Up Form.
5) Fire Alarm/ Sprinkler Disable Request Form.
6) Hot Work Permit Form.
7) Anschutz Medical Campus (AMC) Street and Parking Lot Closure Form.
8) Indoor Air Quality (IAQ) Plan.
9) IAQ Planning Checklist.
10) IAQ Inspection Checklist.
11) Request for Variance.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site for installations, systems or assemblies where required by individual Specification Sections, or where deemed necessary by Contractor.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect/Engineer of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following, as appropriate:

   b. Options.
   c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, approved schedules, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information, including University Project Manager and Architect/Engineer.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to University and Architect/Engineer, but no later than 30 calendar days prior to the scheduled date of Substantial Completion or Partial Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:

   a. University Project Manager.
   c. Architect/Engineer and their consultants.
   d. Contractor’s project manager and superintendent.
   e. Major subcontractors and suppliers.
   f. Other concerned parties.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

   a. Procedures related to:

      1) Notice of Completion, including preparation of Contractor’s punch list.
      2) Final Inspection.
      3) Notice of Substantial Completion.
      4) Notice of Approval of Occupancy/Use.
      5) Supplemental Occupancy/Use Checklist.
6) Supplemental Acceptance Checklist.
7) Pre-acceptance Checklists.
8) Notice of Acceptance.
9) Settlement and Final Payment.

b. Preparation of record documents.
c. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
d. Submittal of written warranties.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. University's partial occupancy requirements.
i. Installation of University's furniture, fixtures, and equipment.
j. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
   a. University Project Manager.
   b. University Health Safety Department Representative.
   d. University Campus Building Official.
   e. Architect/Engineer and their consultants.
   f. Contractor’s project manager and superintendent.
   g. Major subcontractors and suppliers.
   h. Other entities concerned with current progress or involved in planning, coordination, or performance of future activities.
   i. As needed, University Building Maintenance Operations (BMO), Subject Matter Experts (SME), and University Facility Support Services (FSS) Representatives.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule:
      1) Review progress since the last meeting.
      2) Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule.
      3) Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      4) Review schedule for next two week period.
      5) Review schedule of deliveries.
      6) Review off-site fabrication.
   b. Site Safety.
   c. Indoor Air Quality Management monitoring.
d. MS4 Storm Water and Water Quality monitoring.
e. Quality:
   1) Quality and work standards.
   2) Status of correction of deficient items.
   3) Progress cleaning.
   4) Field observations.
f. Status of submittals.
g. Status of RFI's.
h. Status of Changes including:
   1) Change Order Bulletins.
   2) Change Order Proposals.
   3) Change Orders.
   4) Pending claims and disputes.
i. Status of LEED documentation, for projects pursuing LEED certification.
j. Review present and future needs of each entity present including:
   1) Access.
   2) Site utilization.
   3) Temporary facilities and controls.
   4) Coordination.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

F. Pay Application and Schedule Review Meeting: Conduct review meeting monthly on or about the 25th of each month.

1. Attendees:
   a. University Project Manager.
   b. Architect/Engineer.
   c. Contractor’s Project Manager, Superintendent and Scheduler.

2. Agenda: Review draft pay application and progress schedule update in accordance with the requirements of Section 01 29 00 “Payment Procedures” and Section 01 32 00 “Construction Progress Documentation.”

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00
SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Monthly project status reports.
6. Material location reports.
7. Site condition reports.
8. Special reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum exclusive of profit, overhead, and general conditions costs.

C. Event: The starting or ending point of an activity.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either University or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
E. Resource Loading: The allocation of manpower necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file and four paper copies.

B. Startup construction schedule (bar chart).
   1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor’s Preliminary Schedule and Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor’s Detailed Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. Construction Schedule Updating Reports: Submit draft for discussion at monthly project schedule and pay application review meeting. Submit final report with monthly Application for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

PART 2 - PRODUCTS

2.1 CONTRACTOR’S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date is not permitted. Contract completion date may only be modified by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 21 calendar days, unless specifically allowed by Architect/Engineer.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in schedule.
Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

4. Startup and Testing Time: Include adequate time for startup, testing and commissioning.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect/Engineer's administrative procedures necessary for issuing Notice of Substantial Completion.

C. Constraints: Include the following constraints and work restrictions as indicated in the Contract Documents and as applicable in schedule; show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Work by University: Include a separate activity for each portion of the Work performed by University.

3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

4. University-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

5. Work Restrictions: Show the effect of the following items, as applicable, on the schedule:

   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

   a. Submittals.
   b. Mockups.
   c. Fabrication.
   d. Sample testing.
   e. Deliveries.
   f. Installation.
   g. Tests and inspections.
   h. Building flush-out.
   i. Startup and placement into final use and operation.

7. Construction Areas: As applicable, identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Structural completion.
   b. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.
D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Commencement of Work, Substantial Completion, Notice of Occupancy and Use, and Final Acceptance. As applicable, also include milestones for Partial Substantial Completion and Partial Notice of Occupancy and Use.

E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules and as approved by University and Architect/Engineer.

2.2 STARTUP CONSTRUCTION SCHEDULE (BAR CHART)

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven calendar days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART OR GANTT CHART)

A. Bar-Chart or Gantt-Chart Schedule: Submit startup, horizontal, bar-chart-type or a comprehensive, fully developed, horizontal, Gantt-chart-type construction schedule within 30 calendar days of date established for commencement of the Work. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Use the same breakdown of construction activities as indicated in the Schedule of Values.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar. With each required construction schedule update, place a contrasting mark in each bar to indicate actual completion.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

B. Monthly Project Status Report: Prepare a monthly project status report including the following:

1. Current status of Project:
   a. Schedule.
   b. Cost.
   c. MBE and WBE participation, as applicable.
   d. RFI’s.
   e. Submittals.
   f. Manpower.
   g. Safety.

2. Narrative of progress achieved in previous month, activities anticipated for the next month, and issues affecting the rate of progress.
3. Progress photographs in accordance with Section 01 32 33 “Photographic Documentation.”

C. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

D. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to University within one calendar day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise University in advance when these events are known or predictable.
PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule draft update schedule for discussion and review at monthly project progress schedule and pay application review meeting.

1. Revise schedule immediately after each meeting and issue updated schedule concurrently with submittal of monthly Application for Payment.
2. Include summary reports with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.
4. Schedule updates may change logic but may not change milestone or critical path without prior approval of University and Architect/Engineer.

B. Distribution: Distribute copies of approved schedule to Architect/Engineer University, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00
SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
   2. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within three business days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 12 megapixels.
   2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect/Engineer.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to University for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect/Engineer.

1. Take 10 photographs to show existing conditions adjacent to property before starting the Work.

E. Periodic Construction Photographs: Take 10 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take 10 color photographs after date of Substantial Completion for submission as project record documents.

END OF SECTION 01.32.33
SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 02 through 33 for additional submittal requirements specific to indicated Specification Sections.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals." Submittals not specifically indicated as informational submittals are considered to be action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals" and include, but are not limited to:

1. Schedules.
2. Permits.
3. Applications for payment.
4. Performance and payment bonds.
5. Insurance certificates.
7. Schedule of Values.
8. Inspection and test results.
10. Coordination drawings.
12. Anschutz Medical Campus Street Services Request.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a
portion of a network located outside of network firewalls within which internal and external users are able to access files.


### 1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect/Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
3. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for Architect/Engineer's final release or approval.
   h. Scheduled date of fabrication.
   i. Scheduled dates for installation.
   j. Activity or event numbers.

### 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect/Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect/Engineer for Contractor's use in preparing submittals.

1. Architect/Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
   a. Architect/Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
   b. Digital Drawing Software Program: The Contract Drawings are available in Revit 16.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to University and Architect/Engineer.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit for review with sufficient time to avoid construction delays.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect/Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect/Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect/Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
   4. Large and/or Complex Submittals: For large and/or complex submittals, as determined by the Architect/Engineer and for submittals that require sequential reviews by Architect/Engineer's consultants, a review period greater than 14 calendar days may be required. Architect/Engineer and Contractor shall identify such submittals upon submission of the submittal schedule and determine a mutually agreed upon review period.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6x6 on label or beside title block to record Contractor's review and approval markings and action taken by Architect/Engineer.
   3. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Architect/Engineer.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Submittal number or other unique identifier, including revision identifier.
      1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.
      k. Location(s) where product is to be installed, as appropriate.
      l. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect/Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

   a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect/Engineer.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect/Engineer will return without review submittals received from sources other than Contractor.

   a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

      1) Project name.
      2) Date.
      3) Destination (To:).
      4) Source (From:).
      5) Name and address of Architect/Engineer.
      6) Name and address of Contractor.
      7) Name of firm or entity that prepared submittal.
      8) Names of subcontractor, manufacturer, and supplier.
      9) Category and type of submittal.
     10) Submittal purpose and description.
     11) Specification Section number and title.
     12) Specification paragraph number or drawing designation and generic name for each of multiple items.
     13) Drawing number and detail references, as appropriate.
     14) Indication of full or partial submittal.
     15) Transmittal number.
     16) Submittal and transmittal distribution record.
     17) Remarks.
     18) Contractor's certification that information complies with Contract Document requirements.
     19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.

   a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., LNHS-061000-01). Resubmittals shall include an alphabetic suffix after another dash (e.g., LNHS-061000-01-A).

   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect/Engineer.
   4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to University, containing the following information:

      a. Project name.
      b. Date.
      c. Name and address of Architect/Engineer.
d. Name and address of Contractor.
e. Name of firm or entity that prepared submittal.
f. Names of subcontractor, manufacturer, and supplier.
g. Category and type of submittal.
h. Submittal purpose and description.
i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Contractor's certification that information complies with Contract Document requirements.
s. Remarks.

F. Options: Identify options requiring selection by Architect/Engineer.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect/Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Contractor Certification: On transmittal include Contractor's certification that information complies with Contract Document requirements.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect/Engineer's action stamp.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect/Engineer's action stamp.

L. Record Documents: Retain complete additional copies of submittals on Project site to be submitted as record documents in accordance with requirements of Section 01 78 39 “Project Record Documents.”

M. Legibility: Provide clear and legible submittals. Submittals that are blurry or are for any reason unreadable will be returned without action.
PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Action Submittals: Submit three paper copies of each submittal to Architect/Engineer and one to University unless otherwise indicated. Architect/Engineer will return one copy.
2. Informational Submittals: Submit two paper copies of each submittal to Architect/Engineer and one to University unless otherwise indicated. Architect/Engineer will not return copies.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Manufacturer's printed recommendations.
   e. Standard color charts.
   f. Statement of compliance with specified referenced standards.
   g. Statement of compliance with specified trade association standards.
   h. Testing by recognized testing agency.
   i. Application of testing agency labels and seals.
   j. Notation of coordination requirements.
   k. Notation of dimensions verified by field measurement.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Rough-in diagrams and templates indicating clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
7. Submit additional copies of Product Data as required complying with requirements of Section 01 78 39 “Project Record Documents.”

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Highlight, encircle or otherwise indicate deviations from Contract Documents. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect/Engineer's digital data drawing files is otherwise permitted. Standard information prepared without specific reference to the Project is not considered a shop drawing.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than size of Construction Drawings.

D. Selection of Related Materials: Where selections of colors, patterns, textures are specified to be made by Architect/Engineer, assemble complete samples of all specified or approved products for all Specification Sections and submit to Architect/Engineer. Review specifications and assemble all such samples for a combined single submittal. Indicate on the transmittal the latest date for selections to be made for each item to permit delivery of material in accordance with Progress Schedule. Architect/Engineer's action is limited solely to the specified selections or rejection of submittal items not in accordance with Specifications.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect/Engineer.
B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect/Engineer. Submittals received without Contractor’s substantive review and approval stamp will be rejected and returned to the Contractor.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT/ENGINEER'S ACTION

A. Action Submittals: Architect/Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect/Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect/Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect/Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect/Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect/Engineer without action.

END OF SECTION 01 33 00
SECTION 01 35 44

SPECIAL PROCEDURES FOR ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special administrative and procedural requirements related to environmental health and safety.

B. University is Authority Having Jurisdiction (AHJ) for Fire and Life Safety. This responsibility is administered by the University’s Fire and Life Safety Officer.

C. Related Requirements:

1. Section 01 35 46 “Indoor Air Quality Procedures” for procedure related to maintaining indoor air quality during construction.

2. Section 02 81 00 “Transportation/Disposal of Hazardous Materials.”

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY PROCEDURES

A. Physical, Life, and Fire Safety:

1. All contractors are required to conform to the Federal Occupational Safety and Health Administration (OSHA) regulations for construction (29 CFR 1926). Certain General Industry Standards (29 CFR 1910) may also apply, depending on location of work.

2. Provide an effective health and safety program to control hazards, including but not limited to compressed gases, welding, electrical, safety netting, cranes, scaffolding and supplies on the roof.

3. Provide fire protection in all construction areas to the satisfaction of the Authority Having Jurisdiction.

4. During the construction phase, the Authority Having Jurisdiction may conduct oversight inspections to observe and provide recommendations regarding applicable safety standards. The following minimum items are included:

   a. Do not block exit corridors. Install signage clearly identifying exit routes.

   b. Provide physical barriers with appropriate warning signage to protect public areas from construction work.

   c. Conduct daily inspections to eliminate fire hazards and any other safety hazards.

   d. Periodic safety inspections will be performed on job sites by the Authority Having Jurisdiction. The Authority Having Jurisdiction for fire safety will present University’s Project Manager with a written summary of the findings who will then take these issues to the Contractor’s superintendent, foreman or other designated representative and return the summary form with documentation of the resolution of safety items to AHJ. Abate
deficient items in a timely manner. Include documentation and resolution of safety items presented in weekly Progress Meeting minutes. Inspections by University AHJ are spot-checks only. They are not all encompassing. These inspections and recommendations do not relieve the Contractor from obligations related to safe work practices, as required under federal law.

e. AHJ has the right to access the site at all times. Should a potential threat to personnel or property be observed, AHJ may require the hazard related operation immediately altered until adequate safeguards are addressed.

f. Supply AHJ, through the University Project Manager, with a copy of Contractor’s weekly safety meeting minutes and safety inspection reports.

g. Provide signs used for proper identification of construction areas.

h. Provide adequate number of appropriately rated fire extinguishers to be available on-site for emergency use in the construction area.

i. Insure standpipes, pull stations, electrical panels, water control valves and fire hydrants are accessible at all times.

j. Post emergency notification phone numbers provided by Contractor and University in all construction areas.

k. Notify University Project Manager of any lost time injuries occurring on University’s property within one (1) calendar day and of any fatalities immediately.

l. Submit copies of all injury reports to AHJ, through University’s Project Manager.

m. Equip construction personnel with personal protective equipment (PPE) where required. Coordinate with University Project Manager to identify where use of PPE will be required.

B. OSHA Hazard Communication Standard:

1. Every Contractor and Subcontractor performing work shall to comply with the OSHA Hazard Communication Standard. Compliance includes joint University and Contractor responsibilities for the purpose of providing timely communications and information sharing with regard to hazardous materials, chemicals and chemical sources which may be present on-site or brought in by Contractor.

2. University Project Manager will provide Contractor with the following:

   a. Information regarding known hazardous chemicals and agents or other hazards present at the job site.

   b. University emergency procedures and contact numbers.

3. Provide safety training and environmental surveillance of all workers.

4. Inform and provide University’s Project Manager the following:

   a. Material safety data sheets (MSDS) for all chemicals introduced into the workplace.

   b. Information regarding potential sources of pollutants which may be entrained in University's air intakes, e.g., roofing tar fumes, nuisance dusts, exhaust from internal combustion engines, welding or cutting fumes, and asbestos - if damaged or encountered during the course of the work.

C. Asbestos and Lead Paint:

1. The presence of asbestos-containing materials and/or paint containing lead on the job site does not mean a problem exists. Areas where asbestos is friable and not contained or lead paint is present or will be caused to be present in airborne or settled dust are of concern.

2. Responsibilities of University and Contractor regarding asbestos and lead paint are as follows:

   a. University:
1) Notify the Contractor of the condition and location(s) where asbestos is known to be present or may reasonably be encountered, e.g., asbestos insulation, ceiling tiles, floor tiles, fire doors, wall and ceiling plasters, concrete, grouting, etc., and lead paint on metal building materials, walls, windows, etc.

2) Coordinate with Contractor when response action is required by a Subcontractor.

3) Contract with third party contractor to monitor areas where friable asbestos and/or lead-containing particles are present during construction/renovation projects for its own records and purpose. Monitoring results can be shared with Contractors but are in no way to be used for Contractor employee monitoring.

4) Final authority on all asbestos-related concerns and contractual arrangements.

b. Contractor:

1) Notify University's Project Manager of any suspected or existing problem involving asbestos or lead and cease work in that area until University has assessed the situation.

2) Ensure that undamaged asbestos-containing material and/or material containing lead, not included in the scope of the project, are not damaged.

3) Train and monitor their own employees, including Asbestos Awareness training and Lead Paint Awareness training, where applicable.

4) Be responsible for all environmental/industrial hygiene surveillance of its work staff and subcontractors and for required area monitoring where potential contamination of adjacent areas exists.

5) Prevent problems which can result in asbestos or lead exposure to building occupants.

6) Coordinate with the University’s EHS Department and Building Maintenance and Operations through University’s Project Manager and perform all activities that may potentially disturb asbestos containing materials in a manner acceptable to the EHS.

7) Follow State of Colorado regulation, Emission Standards for Asbestos, Part B, Control of Asbestos, “Regulation 8” and OSHA standards regulating exposure to asbestos and lead.

8) Where applicable, comply with Section 02 81 00 “Transportation/Disposal of Hazardous Materials.”


D. Carcinogens:

1. Contractor or any Subcontractor shall not knowingly install or cause to be installed any material or product containing carcinogens. Refer to Annual Report on Carcinogens, U.S. Department of Health and Human Services, National toxicology Program.

E. Hazardous Waste:

1. All hazardous wastes are to be handled and disposed of according to current EPA and CDPHE guidelines which can be obtained through University Project Manager. Only individuals specifically authorized by University may sign hazardous waste manifests for wastes generated on University’s property. Only University approved transporters and disposal facilities are to be used for transportation and disposal of hazardous wastes.

F. The Control of Hazardous Energy (Lockout/Tagout):

1. Provide and enforce a program and procedures for the control of hazardous energy (lockout/tagout) including, but not limited to, locks, tags and lockout devices. Provide proof that workers have received safety training in the control of hazardous energy through lockout/tagout.
G. Hot Work Operations:

1. Comply with University hot work policy and obtain Hot Work Permit prior to executing any hot work in existing buildings.
2. Notify University Project Manager prior to any hot work on University property.
3. Provide and enforce a program to control fires during hot work operations. Provide appropriately rated fire extinguishers, fire retardant protective covers (when needed), and any other hot work related equipment.

H. Confined Space Entry:

1. Work in compliance with the “Confined Spaced Entry Procedure for Non-University Personnel” whenever any project requires entry into a confined space. A copy of this procedure can be obtained from University EHS through University’s Project Manager.

I. Green Tagging of Work Area:

1. Obtain a Green Tag and Construction Permit from the University Project Manager prior to any work being conducted in a laboratory or on any exhaust ductwork system serving a laboratory. If a Green Tag has been issued, it will be displayed at the entry of the laboratory area. The Green Tag assures that any radioactive, chemical or biological materials have been removed from the laboratory verifying the area is free from hazards to workers. If a Green Tag is not displayed, coordinate tagging with EHS through University’s Project Manager.

END OF SECTION 01 35 44
SECTION 01 35 46

INDOOR AIR QUALITY PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for managing emissions and moisture control during construction.

1.2 DEFINITIONS

A. Sustainable Design Related Terminology: As defined is ASTM E 2114.

B. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.

1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.

E. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces including but not limited to flooring, wallcovering, finish carpentry, and ceilings.

F. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging including but not limited to carpets, resilient flooring, ceiling tiles, and insulation.

G. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.3 QUALITY ASSURANCE

A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.
1.4 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with University and Architect/Engineer to review and discuss the proposed IAQ Management Plan and develop a mutual understanding of detailed requirements for maintaining indoor air quality and environmental protection.

1.5 SUBMITTALS

A. Indoor Air Quality (IAQ) Management Plan: Not less than 10 business days before the Pre-construction meeting, prepare and submit an IAQ Management Plan including, but not limited to, the following:

1. Procedures for control of emissions during construction.
   a. Identify schedule for application of interior finishes.

2. Procedures for moisture control during construction.
   a. Identify porous materials and absorptive materials.
   b. Identify schedule for inspection of stored and installed absorptive materials.

3. Revise and resubmit Plan as required by University.
   a. Approval of Contractor’s Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

B. Product Data:

1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
2. Submit air pressure difference maps for each mode of operation of HVAC.
3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products. Coordinate with Section 01 78 23 – Operation and Maintenance Data.
   a. Adhesives.
   b. Floor and wall patching/leveling materials.
   c. Caulking and sealants.
   d. Insulating materials.
   e. Fireproofing and firestopping.
   f. Carpet.
   g. Paint.
   h. Clear finish for wood surfaces.
   i. Lubricants.
   j. Cleaning products.

C. Inspection and Test Reports:

1. Moisture control inspections.
2. Moisture content testing.
3. Moisture penetration testing.
4. Microbial growth testing.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

A. Provide point person responsible for the implementation and assurance that the Indoor Air Quality Plan is being implemented.

B. University Indoor Air Quality Plan: Comply with the requirements of the University IAQ Plan, latest version, appended to this Specification Section.

C. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

3.2 IAQ MANAGEMENT - MOISTURE CONTROL

A. Housekeeping:
   1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
   2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
   3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.

B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
   1. Examine materials for dampness as they arrive. If acceptable to University, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
   2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
   3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect weekly.
      a. Where stored on-site or installed absorptive materials become wet, notify Architect/Engineer and University. Inspect for damage. If acceptable to University, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
   4. Basement: Monitor basement and crawlspace humidity, and dehumidify when relative humidity is greater than 85 percent for more than 2 weeks or at the first sign of mold growth.
   5. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.
   6. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
      a. Air and weather-resistive barrier: Verify air and weather-resistive barrier is installed without punctures and/or other damage. Verify air barrier and weather-resistive is sealed completely.
      b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
      c. Insulation layer: Verify insulation is installed without voids.
d. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair

7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.

8. HVAC: Inspect HVAC system as specified in Section 23 08 00 – Commissioning.
   a. And, inspect HVAC to verify:
      1) Condensate pans are sloped and plumbed correctly.
      2) Access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils.
      3) Ductwork and return plenums are air sealed.
      4) Duct insulation is installed and sealed.
      5) Chilled water line and refrigerant line insulation are installed and sealed.

C. Schedule:
   1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
   2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air and weather-resistive barriers, flashing, exterior sealants and roofing, at the earliest possible time.

D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.
   1. Concrete: Moisture test prior to finish flooring application as specified in Division 09.
   2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.
   3. Gypsum Board, Gypsum Plaster, Insulation, and other absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.

E. Testing for Moisture Penetration:
   1. Windows: Test as per ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference at 100 percent static-air-pressure difference specified in applicable Division 08 Sections; unless otherwise indicated, acceptable upper limits are no leakage for 15 minutes.
      a. Number of Tests: 1 percent of openings but not less than two.
   2. Horizontal Waterproofing (not roofing): Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are no leakage for 15 minutes.
      a. Test frequency: 100 percent of horizontal waterproofed surfaces.
3. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are no leakage for 15 minutes.

4. Exterior Walls:
   
a. Air tightness of the enclosure test: ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or ASTM E1827
      
      1) Air Leakage: The mean value of the air leakage flow rate calculated from measured data at 0.3 in wg (75 Pa) must not exceed 0.25 cu ft/ minute per square foot of envelope area. Measurements must be referenced at standard conditions of 14.696 psi (101.325 KPa) and 68 deg F.

F. Testing for Support of Microbial Growth: Test and report in accordance with ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers. Indicate susceptibility of product or material to colonization and amplification of microorganisms. Identify microorganisms and conditions of testing.

1. Normal conditions: Perform testing at 35 degrees Centigrade and 50 percent relative humidity.
2. Extreme conditions: Perform worst case scenarios screening tests by providing an atmosphere where environmental conditions may be favorable for microbial growth.
3. Perform testing for the following:
   
a. Fireproofing material on appropriate substrate.
   b. Ceiling tile.
   c. Wall covering.
   d. Other appropriate material.

END OF SECTION 01 35 46
Indoor Air Quality Plan
March 1, 2012

This plan describes the measures to be taken to provide good indoor air quality (IAQ) during construction and after construction is complete and the occupants have moved into the building. This plan is based on the SMACNA standard “IAQ Guidelines for Occupied Buildings under Construction” and the requirements of the LEED.

It is not the intent of this document to replace or supersede OSHA regulations as to safe construction workplace practices. It remains the responsibility of the Construction Manager and the individual sub-contractors to maintain safe building and site operations. Addition precautions may be necessary when hazardous materials are present.

The plan will address construction IAQ by recommending procedures in five areas of concern, which in turn will allow the building to achieve two LEED program points:

- HVAC system protection
- Containment source control
- Pathway interruption
- Housekeeping
- Scheduling

The following describes the specific measures to be performed in each area of concern:

1. HVAC Protection
   - During construction, provide MERV 13 filters for supply air intake when in use. Provide MERV 8 filters at the return air system openings when in use. Perform frequent maintenance when the HVAC system is being utilized and replace filters as they become loaded, prior to building flushout, and prior to occupancy.
   - When performing construction activities that produce dust, such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation, seal off the supply diffusers and return air system openings completely for the duration of the task.
   - Shut down and seal off the supply diffusers and return air ducts during any demolition operations.
   - Whenever the HVAC system is not used during construction, seal off the supply diffusers and return air system openings to prevent the accumulation of dust and debris in the duct system.
   - Do not use the mechanical rooms to store construction or waste materials. Keep rooms clean and neat.
   - Provide periodic duct inspections during construction; if the ducts become contaminated due to inadequate protection, clean the ducts professionally in accordance with NADCA (National Air Duct Cleaning Association) standards.
   - The General Contractor shall take photographs showing measures in place.

2. Source Control
   - Use low VOC products as indicated by the specifications to reduce potential problems.
   - Restrict traffic volume and prohibit idling of motor vehicles where emissions could be drawn into the building.
Utilize electric or natural gas alternatives for gasoline and diesel equipment where possible and practical. Use low-sulfur diesel in lieu of regular diesel.

Cycle equipment off when not being used or needed.

Exhaust pollution sources to the outside with portable fan systems. Prevent exhaust from recirculating back into the building from construction equipment outside the building.

Keep containers of wet products closed as much as possible. Cover or seal containers of waste materials that can release odor or dust.

Protect stored on-site or installed absorptive building materials from weather and moisture; wrap with plastic and seal tight to prevent moisture absorption.

The General Contractor shall take photographs showing measures in place.

3. Pathway Interruption

- Provide dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable.
- Locate pollutant sources as far away as possible from supply ducts and areas occupied by workers when feasible. Supply and exhaust systems may have to be shut down or isolated during such activity.
- During construction, isolate areas of work to prevent contamination of clean or occupied areas. Pressure differentials may be utilized to prevent contaminated air from entering clean areas.
- Depending on weather, ventilation using 100% outside air will be used to exhaust contaminated air directly to the outside during installation of VOC emitting materials.

4. Housekeeping

- Provide regular cleaning concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to occupancy.
- All coils, air filters, fans and ductwork shall remain clean during installation and, if required, will be cleaned prior to performing the testing, adjusting and balancing of the systems.
- Suppress and minimize dust with wetting agents or sweeping compounds. Utilize efficient and effective dust collecting methods such as a damp cloth, wet mop, or vacuum with particulate filters, or wet scrubber.
- Remove accumulations of water inside the building. Protect porous materials such as insulation and ceiling tile from exposure to moisture.
- Thoroughly clean all interior surfaces prior to replacing filters and running HVAC system for system balancing, commissioning and building flushout.
- Provide photographs of the above activities during construction to document compliance.

5. Scheduling and Construction Activity Sequence

- Schedule high pollution activities that utilize high VOC level products (including paints, sealers, insulation, adhesives, caulking and cleaners) to take place prior to installing highly absorbent materials (such as ceiling tiles, gypsum wall board, fabric furnishing, carpet and insulation, for example). These materials will act as ‘sinks’ for VOCs, odors and other contaminants, and release them later after occupancy.

PLANNING AND INSPECTION CHECKLISTS

The planning and inspection checklists included in this document are useful to ensure construction IAQ management is planned and implemented correctly. The planning checklist should be completed by the contractor prior to construction. The inspection checklists should be completed monthly to confirm the IAQ management plan is being followed. At the time of inspection, photographs should be taken to support the checklist and to provide audit documentation for the USGBC.
Planning Checklist
(Must be completed weekly)

Project _________________________________________________________________

Completed by: ____________________________________________________________

(Name & Company)  

Date: ___________________________________________________________________

1. HVAC Protection
   - MERV 13 filters at supply air intake
   - MERV 8 filters at return air openings
   - Seal supply diffusers and return air during demolition
   - Seal supply diffusers and return air openings during construction
   - Mechanical rooms clean and neat
   - Periodic duct inspections during construction
   - General Contractor to document with photographs

2. Source Control
   - Low/no VOC products as indicated by specifications
   - Restrict vehicle traffic volume and prohibit idling
   - Utilize electric or natural gas alternatives for gasoline and diesel
   - Cycle equipment off when not being used or needed
   - Exhaust pollution sources to the outside
   - Keep containers of wet products closed
   - Cover or seal containers of waste materials
   - Protect absorptive building materials from weather and moisture
   - Prevent fume migration from construction vehicles and equipment into adjacent buildings
   - General Contractor to document with photographs

3. Pathway Interruption
   - Provide dust curtains or temporary enclosures
   - Locate pollutant sources as far away as possible from supply dusts and areas occupied by workers
   - General Contractor to document with photographs
   - Isolate areas of work to prevent contamination of clean or occupied areas
   - When using VOC emitting materials ventilate using 100% outside air
4. **Housekeeping**

- Provide regular cleaning, including HVAC equipment
- If necessary, clean HVAC equipment prior to testing, adjusting and balancing the systems
- Suppress and minimize dust with wetting agents or sweeping compounds
- Remove accumulations of water inside the building
- Protect porous materials
- General Contractor to document with photographs

5. **Scheduling and Construction Activity Sequence**

- Schedule high pollution activities prior to installing absorbent materials
- General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: _______________________________  Date: ________________

(Contractor)
University of Colorado Denver IAQ
February 14, 2009

Inspection Checklist
(Must be completed weekly)

Project _________________________________________________________________
Completed by: _________________________________________________________________
(Name & Company)
Date: ________________________________

1. HVAC Protection
   - MERV 13 filters at supply air intake
   - MERV 8 filters at return air openings
   - Seal supply diffusers and return air during demolition
   - Seal supply diffusers and return air openings during construction
   - Mechanical rooms clean and neat
   - Periodic duct inspections during construction
   - General Contractor to document with photographs

2. Source Control
   - Low/no VOC products as indicated by specifications
   - Restrict vehicle traffic volume and prohibit idling
   - Utilize electric or natural gas alternatives for gasoline and diesel
   - Cycle equipment off when not being used or needed
   - Exhaust pollution sources to the outside
   - Keep containers of wet products closed
   - Cover or seal containers of waste materials
   - Protect absorptive building materials from weather and moisture
   - General Contractor to document with photographs

3. Pathway Interruption
   - Provide dust curtains or temporary enclosures
   - Locate pollutant sources as far away as possible from supply dusts and areas occupied by workers
   - General Contractor to document with photographs
   - Isolate areas of work to prevent contamination of clean or occupied areas
   - When using VOC emitting materials ventilate using 100% outside air
   - General Contractor to document with photographs

4. Housekeeping

IAQ Inspection Checklist
REV: 02/14/09
Provide regular cleaning, including HVAC equipment
If necessary clean HVAC equipment prior to testing, adjusting and balancing the systems
Suppress and minimize dust with wetting agents or sweeping compounds
Remove accumulations of water inside the building
Protect porous materials
General Contractor to document with photographs

5. Scheduling and Construction Activity Sequence
- Schedule high pollution activities prior to installing absorbent materials
- General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: ___________________________________________  Date:  ________________

(Contractor)
SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Related Requirements:

1. Section 01 42 00 "Reference" for list of references, standards and definitions.
2. Section 01 91 13 “General Commissioning” for coordination of testing with commissioning activities.
3. Division 23 for testing, adjusting and balancing of mechanical systems.
4. Division 26 for testing of electrical systems.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect/Engineer.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect/Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect/Engineer for a decision before proceeding.

1.4 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For University's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
   1. Monitor quality control over products, services, site conditions, and workmanship to produce work of specified quality.
   2. Comply fully with manufacturers' instructions, including each step in sequence.
   3. If manufacturers' instructions conflict with Contract Document requirements, request clarification from Architect/Engineer before proceeding.
   4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
   5. Perform work by persons qualified to produce workmanship of specified quality.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Subcontractor and Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance. In addition comply with the following:
   1. For all trades: Proof of applicable licensing.
   2. Electrical contractors:
   3. Plumbing Contractors:
c. Gas piping installations: State of Colorado master plumber with minimum 5 years institutional or heavy commercial gas piping experience. Provide an on-site supervisor with a minimum of 3 years of supervisory experience.

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

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 or ASTM D 3740 as appropriate; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
4. Authorized to operate in the State of Colorado.
5. Calibrate testing equipment at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or of accepted values of natural physical constants.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. When required, build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. When required, build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups, as applicable; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect/Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.6 QUALITY CONTROL

A. University Responsibilities: Where quality-control services are indicated as University's responsibility, University will engage a qualified testing agency to perform these services.

1. University will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made by the University.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to University are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by University, unless agreed to in writing by University.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

1. Notify Architect/Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples including, but not limited to, safe storage and proper curing of concrete test cylinders at Project site for first 24 hours after casting as required by ASTM C 31.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Manufactured Items and Equipment: Where manufactured products or equipment are required to have representative samples tested, do not use such materials or equipment until tests have been made and the materials or equipment found to be acceptable. Do not incorporate in the work any product which becomes unfit for use after acceptance.

J. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to University, Architect/Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: University will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of University, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect/Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect/Engineer with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG
A. Test and Inspection Log: Prepare a record of tests and inspections including instructions received from University. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect/Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.
5. Disposition: Pass, fail, nature of defects, if any.
6. Date and descriptions of remedial or correction action taken.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect/Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION
A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.3 SCHEDULE OF INSPECTIONS AND TESTS BY UNIVERSITY
A. University will engage testing agency and pay for testing and inspection associated with the following materials and systems, where included in the Project:

1. Compaction density of fill and backfill.
2. Drilled pier end bearing conditions and depths.
4. Precast concrete.
5. Post-tensioned concrete tendons.
7. Structural steel field welds and bolted connections.
8. Spray-applied fireproofing.
10. Asphalitic concrete paving.
11. Foundation drainage systems.
12. Drainage structures and piping.
15. Fluid applied membranes.
16. Thermal imaging.
17. Curtain wall, window, and door field testing.
18. Ceiling hanger wire pull-out.
20. Field sound testing of operable partitions.
22. Fan vibration.

END OF SECTION 01 40 00
SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building Department Authority.
   2. MS 4 Storm Water and Water Quality Permits
   3. Applicable Codes and Standards.

1.2 BUILDING DEPARTMENT AUTHORITY

A. The University of Colorado Denver is charged with the responsibility of ensuring that provision of applicable codes, standards and guidelines are met on its campuses.

B. The University Denver campus has an established Building Authority responsible to review and examine buildings and plan documents, to permit and inspect construction and/or demolition to ensure conformance to codes adopted by the University and issue certificates of temporary occupancy and occupancy if satisfactory conformance is demonstrated.

C. The authority is executed by the Campus Building Official (CBO) who has the responsibility to perform all the duties set forth in the Current Approved State Buildings Codes and other applicable codes and standards indicated in the “Applicable Codes and Standards” Article of this Section.

D. Permits: Obtain a separate permit for each Project from the Office of the CBO prior to erecting, constructing, enlarging, repairing, moving, removing, converting or demolishing any building or portion thereof. Coordinate and obtain all permits through the University Project Manager. The Contractor is not responsible for costs associated with construction permits.

1. Exempt work: A building permit is not required for the following:
   a. Fences less than or equal to 6 feet tall.
   b. Movable casework, counters and partitions not over 5 feet 9 inches tall with no electrical or plumbing.
   c. Platforms, walks, and driveways not more than 30 inches above grade and not over any basement or story below.
   d. Painting, papering and similar finish work.
   e. Other work of limited scope at the discretion of the CBO.

E. Permit Issuance: The CBO, or at the discretion of the CBO a third party code consultant, will review application, Drawings, Specifications, computations and other data filed for permit. Complete the permit application with the University Project Manager. Permits require submittal of two (2) stamped, signed sets of Construction Documents, including Drawings, Specifications and all Addenda, and one (1) set of each engineering discipline’s calculations, where such calculations are required. If CBO determines that submittal conforms to the requirements of the Building Code and other applicable codes, standards, laws, regulations and ordinances, an inspection record card will be issued with the building permit. Keep one
stamped set of documents on site. The University will keep one stamped set in the Campus Support plan room.

F. Suspension or Revocation of Permit: CBO may, in writing, suspend or revoke a permit issued in error or on the basis of submitted information that is incorrect or that is in violation of the Building Code and other applicable codes and standards.

G. Posting of Permit: Post the Permit in a visible and protected location near the access to the project.

H. Inspection Record Card: Post the Inspection Record Card next to the permit in a visible and protected location near the access to the project. CBO will make required entries based on inspection of the work.

I. Inspection Requests:
   1. Notify CBO that work is ready for inspection two business days before such inspection is desired by telephoning the number posted on the permit. The CBO retains the right to require requests in writing.
   2. A re-inspection fee may be charged for prior rejected items.

J. Construction Inspections:
   1. Contractor is not responsible for costs associated with construction inspections, except re-inspections. The CBO or his/her designee will perform all general building, electrical and plumbing inspections. All construction or work for which a permit is required must remain accessible and exposed for inspection purposes. Provide access to and means for inspection of work.
   2. Site Utilities: Contact and comply with all requirements of City of Aurora.
   3. Plumbing and Electrical Inspections: For new buildings and major additions, contact and comply with all requirements of State of Colorado Plumbing and Electrical Boards.
   4. Provisions for structural and other special inspections required by Contract Documents, current approved State Building Codes and University Codes will be provided by the University.

K. Certification of Occupancy:
   1. When CBO inspects the project and finds no violations of any provision of the Building Code, other applicable codes, standards, laws, regulations and ordinances, CBO will issue a Certification of Occupancy (CO) which will contain the following:
      a. Building permit number.
      b. Address of building.
      c. Name and address of Owner.
      d. Description of building or portion thereof for which certification is issued.
      e. Statement that described building or portion thereof has been inspected for compliance with the requirements of the Building Code, other applicable codes, standards, laws, regulations and ordinances, as relates to type of occupancy and use for which the building is intended.
   2. Temporary Certificate of Occupancy (TCO): If CBO finds no substantial hazard will result from occupancy of any building or portion thereof before the same is completed, CBO may issue a TCO for the use of a portion or portions of a building or structure prior to the completion of the entire building or structure.
3. Posting of CO: Provide a copy to the University Project Manager and post in a conspicuous location on the premises. CO may not be removed except by CBO upon initial occupancy.

4. Revocation of CO:

1.3 MS4 STORM WATER AND WATER QUALITY PERMITS

A. The University has a non-standard MS4 permit for entire Anschutz Medical Campus (AMC) that requires University oversight of campus construction and its water quality impact. Contractors are required to prepare Storm Water Quality Plans and obtain State of Colorado CDPHE permits for all projects that impact site. In addition, Contractors shall comply with the University MS4 permit requirements, including keeping written record of weekly inspections of Storm Water Quality measures and attaching record to the weekly Progress Meeting minutes. Submit the plan, permits, and evidence of final closeout to University Project Manager who will copy all such storm water documents to University Engineering Department. Coordinate with University Project Manager who will arrange for University Grounds Manager to attend monthly inspections and closeout walk.

1.4 APPLICABLE CODES AND STANDARDS

A. The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects. Current applicable codes can be obtained from The Office of the State Architect’s website.

B. University of Colorado Denver Codes and Standards: The following codes and standards supplement those indicated on the Office of the State Architect website.


   a. Use the most restrictive interpretation where NFPA 101 conflicts with the IBC requirements.


21. CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL); latest edition.


C. Other Standards: As indicated in individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 41 00
SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Definitions.
   2. Industry Standards.
   3. Abbreviations and Acronyms.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

   1. Referenced standards take precedence over standards that are not referenced but generally recognized in the construction industry as applicable.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents.

   1. Updated Codes and Standards: Where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected, submit Contractor-Initiated Change Order Bulletin and Change Order Proposal in accordance with Section 01 26 00 “Contract Modification Procedures” for consideration to modify contract requirements to comply with revised code or standard.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Unreferenced Standards: Unreferenced standards are not directly applicable to the Work, except as a general requirement of whether the Work complies with recognized construction industry standards.

E. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.
ABBREVIATIONS AND ACRONYMS

A. Industry abbreviations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale’s “Encyclopedia of Associations” or in Columbia Books’ “National Trade & Professional Associations of the U.S.”

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1. Nothing in this Section is intended to limit types and amounts of temporary work required, and no omission from this Section will be recognized as an indication by Architect/Engineer that such temporary activity is not required for successful completion of the Work. The use of alternative facilities equivalent to those specified is the Contractor's option, subject to Architect/Engineer's and University acceptance.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 01 35 46 “Indoor Air Quality” for temporary facility work including HVAC, air filtration, moisture management, air filtration and dust control partitions required to comply with indoor air quality requirements during construction.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, University's construction forces, Architect/Engineer, testing agencies, and authorities having jurisdiction.

B. Use Charges: As follows:

1. For renovations of existing facilities: Arrange for and University will pay for all use charges.

C. Temporary Metering: For all utility connection; sub-meter at point of connection to existing systems.

1. Temporary utility meter must be approved by University Campus Energy Engineer.
2. Meters shall be operational prior to any use of utility for temporary heating.

1.3 INFORMATIONAL SUBMITTALS

A. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. General: Comply with governing regulations and utility company regulations and recommendations for the construction of temporary facilities including, but not necessarily limited to, code compliances, permits, inspections, testing, health, safety, pollution and environmental compliances.


D. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

F. Accessible Temporary Egress: Where temporary accessible egress from existing buildings or portions thereof is provided, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before University's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide both new or used materials and equipment for temporary facilities, which are in substantially undamaged and serviceable condition. Provide types and qualities which are recognized in the construction industry as suitable for the intended use in each application. Comply with Utility Company requirements as applicable.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: By arrangement with the University, use of space within the existing building will be permitted for Contractor as use for field office.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.
2. Comply with Section 01 10 00 “Summary” for use of site for staging areas.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Digital Camera: Minimum 12 megapixel; available in field office for use.

C. Thermometer: Outdoor, re-settable type indicating daily maximum and minimum temperatures.
   1. Locate in a shaded-from-the-sun, conveniently readable location that will give reasonably accurate readings of the actual air temperature and be reached easily for resetting.

D. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate, expand and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Use qualified workers for the installation of temporary facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, University, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Comply with requirements in Section 01 10 00 “Summary” for existing utility disruption procedures.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Where available, connect to University's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to University. At Substantial Completion, restore these facilities to condition existing before initial use.
   1. Obtain and pay for all required water taps.
D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of University's existing toilet facilities is not permitted.
2. Provide temporary toilets within available site area in location approved by University which will best serve the needs of construction personnel.
3. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each sanitary facility, and provide appropriate waste paper containers for used materials.
4. At Contractor’s option, provide drinking water for construction personnel by either water-system-connected drinking fountains or by containerized tap dispensers with paper cups (or both).

E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. HVAC Equipment: Unless University authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   b. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   c. Permanent HVAC System: If University authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air and exhaust grille in system and remove at end of construction. Clean and adjust HVAC system and put in new condition before Completion as required in Section 01 77 00 "Closeout Procedures".

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide weatherproof, grounded, electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Include, as required, transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switchgear. Maintain equipment in a condition acceptable to University.

1. Install electric power service overhead unless otherwise indicated.
2. Where available capacity exists in existing system, connect temporary service to University's existing power source, as directed by University.
3. Provide separate connection for power and for lighting.
4. Provide sufficient 220v outlets for special tools, welding equipment and similar devices requiring such service at locations where required.
5. Provide sufficient circuits and duplex 120v single phase outlets so located that any part of the work can be reached with a 75 foot extension cord to accommodate normal power tools and supplemental lighting.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Provide temporary light to levels and as required by governing regulations but not less than minimum 5 foot-candle illumination in all areas accessible to workers during hours they are at the job; minimum 10 foot-candles for shop areas; 20 foot-candles or more where detailed or finishing work is being done, supplemented as may be required.
2. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
3. Install lighting for Project identification sign.
4. Where permanent light fixtures have been used for temporary lighting, supply temporary lamps and replace with new lamps at time of Completion.
5. Provide lighting in stairways and exits at all times.

J. Telephone Service: Provide temporary telephone service in Contractor’s field office and distribute to each work station.

1. Pay for line installation, monthly charges, and expenses necessary to extend service from minimum point of presence (MPOP) as determined by University I/S.
2. Provide temporary telephone service in common-use facilities for use by all construction personnel.
3. Provide answering machine and a dedicated telephone line for a facsimile machine.
4. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to University.
B. Parking: Comply with requirements in Section 01 10 00 “Summary.”

C. Project Signs:
   1. Temporary Signs: Provide signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   2. Engage an experience sign painter to apply required colors and graphics in a neat and professional manner.
   3. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
   1. Coordinate with University Project Manager to obtain approval from University Environmental Services Manager.
   2. Provide waste chutes as required in accordance with applicable laws and regulations.

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. The selection of type, size and number of hoisting facilities is the solely the responsibility of the Contractor.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Existing Elevator Use: When approved by University, one designated existing elevator may be used at no charge to Contractor or other subcontractors for transporting personnel, small tools, materials, and equipment. Comply with requirements of Section 01 10 00 “Summary” and the following:
   1. Contractor will not be granted exclusive use of the designated elevator. University personnel and staff will be permitted to use this elevator as their work duties require.
   2. Entire car is lined (floor, walls, ceiling) with 3/4 inch Fir plywood or equivalent.
   3. Total load carried does not exceed rated capacity of elevator.
   4. No materials, equipment, trash, tools or other items too large to be readily moved into and out of the car may be carried in the elevator.
   5. Before acceptance of the building, linings are removed; all exposed surfaces are in new condition; all controls, relays, other parts showing any wear have been replaced.
   6. Entire elevator, including machinery, electrical components, doors, operators and controls shall be tested, adjusted, and put in new condition with specified warranties and maintenance to take effect at date of Completion Certificate.
   7. Written clearance has been obtained from the Elevator Service Company stating that the installation is safe and complete for this use prior to using it.
   8. The Contractor signs the Elevator Service Company's standard agreement and release forms for this usage and pays charges for maintenance, service, repairs, and reconditioning.

G. Existing Stair Usage: Use of University's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to University. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Protection of Work: Protect in-progress and completed work from damage or deterioration, other than normal weathering of exposed materials, through construction duration until completion, as appropriate and as recommended by manufacturer and Installer.

1. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects, and storage.
2. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.
3. Always protect excavation, trenches, and building, from damage from rain water, spring water, ground water, backing up of drains or sewers. Provide pumps, equipment, enclosures, to provide this protection.
4. Remove protective coverings and materials at the appropriate time but no later than final cleaning operations.

C. Security: Provide security program and facilities to protect the Work, existing facilities, and University operations and to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Coordinate with University Police.
2. Provide lockable entrances and lock entrances at end of each work day.
3. After review and approval by University, install temporary enclosure around partially completed areas of construction.
4. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting wherever required to prevent accidents and losses.

E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

F. Temporary Partitions: Provide floor-to-floor or floor-to-ceiling dustproof partitions terminating in dustproof floor or ceiling above to limit dust and dirt migration and to separate existing active elevator hoistways and other areas occupied by University from dust, fumes and noise in compliance with Section 01 35 46 “Indoor Air Quality” and the following:

1. Construct dustproof partitions with 5/8 inch gypsum wallboard with joints taped on occupied side, and 1/2 inch fire-retardant-treated plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.
7. At elevator hoistway entrances not used during construction, seal openings with plastic sheet and duct tape.
G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Fire Extinguishers: Minimum one per floor at or near useable exit.
   a. Provide additional extinguishers where convenient and effective for intended purpose.
   b. Comply with NFPA 10 to the extent applicable.

2. Strictly enforce site prohibition against smoking.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
4. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Coordinate with University Project Manager to review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
5. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
6. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes for fighting fires.
7. Store combustible materials in containers in fire-safe locations.
8. Permanent Fire Protection System: Complete and make operational at earliest possible date. Instruct site personnel on use of permanent system.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Comply with requirements in Section 01 35 46 “Indoor Air Quality Procedures.”

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

1. Do not permit temporary offices and similar temporary or permanent spaces to be used as living quarters or for other unintended occupancies or uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Janitorial Services: Provide daily janitorial services for temporary offices, toilets, and similar areas at the project site. Require users of other temporary facilities to maintain clean and orderly premises.

D. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

E. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion, unless Architect/Engineer requests that it be retained for a longer period of time. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. University reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00
SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
3. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
4. Section 01 42 00 "References" for applicable industry standards for products specified.
5. Section 01 77 00 “Closeout Procedures” for submittal of project warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Requests for consideration of comparable products will only be entertained during bidding.
2. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
3. Architect/Engineer's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation of a comparable product request. Architect/Engineer will notify Contractor of approval or rejection of proposed comparable product.

   a. Form of Approval: Written Addendum.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 “Submittal Procedures.” Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

B. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.

   1. Name of product and manufacturer.
   2. Model and serial number.
   3. Capacity.
   4. Speed.
   5. Ratings.
   6. Power characteristics (if applicable).
   7. UL label or compliance (if applicable).

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to
determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure
   above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation
   and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation,
   and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties
required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties
do not relieve Contractor of obligations under requirements of the Contract Documents. Such disclaimers
and limitations do not relieve warranty requirements on Work that incorporates product nor do they
relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the
Contractor.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular
   product and specifically endorsed by manufacturer to University.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific
   rights for University.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready
for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly
   executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written
   document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting
   special warranties.

C. Submittal Time and Form: Comply with requirements in Section 01 77 00 "Closeout Procedures."

D. Warranty Requirements:

1. Related Damages and Losses: When correcting warranted Work that has failed, remove and
   replace other Work that has been damaged as a result of such failure or that must be removed and
   replaced to provide access for correction of warranted Work.
2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by
   replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty
   shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or
   rebuild the Work to an acceptable condition complying with requirements of Contract Documents.
   The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of
   whether the University has benefited from use of the Work through a portion of its anticipated
   useful service life.
4. University's Recourse:
   a. Written warranties made to the University are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the University can enforce such other duties, obligations, rights, or remedies.
   b. Rejection of Warranties: The University reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
   c. The University reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged, are asbestos free, and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. University reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect/Engineer will make selection.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product and provide only products previously approved during bid phase by written Addendum. The determination of equivalence is at the sole discretion of the Architect/Engineer who has no obligation to prove non-equivalence.
   7. Mechanical and electrical equipment design and their space requirements are based on the first named item of the Section in which specified or that scheduled on the Drawings. If other than the first named or scheduled item listed for use is selected, modification to other elements of Work may be required. Show all such modification on shop drawings and submittals as appropriate. The cost of such modifications is solely the responsibility of the Contractor.
   8. Where manufacturers are listed as acceptable for specific proprietary products but precise identification by model, series, or trade name is not specified, submit detailed product information for such products for Architect/Engineer's acceptance prior to ordering. Include specific requirements for modifications to other construction, including but not limited to, power and utility requirements, characteristics, capacities, size and locations. The cost of such modifications is solely the responsibility of the Contractor.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. If proposing a comparable product by another manufacturer, whether named or not, provide a custom product if manufacturer's standard product does not include salient features of the Basis-of-Design product indicated. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

6. Contractor's Option: Where materials, products, systems or methods are specified to be selected from a list of options, subject to compliance with requirements, the choice of which material, method, product or system will be solely at the Contractor's discretion. There will be no change in Contract Sum or Time because of such choice.

C. Visual Matching Specification: Where Specifications require "match Architect/Engineer's sample", provide a product that complies with requirements and matches Architect/Engineer's sample. Architect/Engineer's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect/Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect/Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Prior to bid, Architect/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will reject request:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00
SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of University-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site and procedures related to utility interruptions.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan and Request: Submit plan and request describing procedures at least 21 calendar days prior to the time cutting and patching will be performed.

1. Submit request whenever cutting and patching operation affect:

   a. Work of the University or any separate contractor.
   b. Structural value or integrity of any element of the Project.
   c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
   d. Efficiency, operational life, maintenance or safety of operational elements.
   e. Visual qualities of sight-exposed elements.
   f. Cutting new openings in existing structural concrete walls, floors and suspended slabs.
   g. Cutting new openings in existing roofs and roofing materials.
   h. Cutting exterior walls.
   i. Cutting into shafts.
2. Include the following information:
   a. Extent: Describe reason for and extent of each occurrence of cutting and patching, including explanation of why cutting and patching operation cannot be reasonably avoided.
   b. Changes to In-Place Construction: Describe cutting and patching methods and anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   c. Products: List products to be used for patching and firms or entities that will perform patching work.
   d. Trades: Indicate trades and subcontractors who will perform the work.
   e. Dates: Indicate when cutting and patching will be performed.
   f. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      1) Include description of provisions for temporary services and systems during interruption of permanent services and systems.
      2) Comply with requirements of Section 01 10 00 “Summary” related to existing utility and system interruptions.
   g. Structural Elements: Where cutting and patching structural elements requires the addition of reinforcement, submit details and calculations signed and sealed by an Engineer registered in the State of Colorado. Indicate how new reinforcing will be integrated with original structure.

3. Limitations: Approval of cutting and patching request does not waive right of Architect/Engineer or University to later require complete removal and replacement of work found to be unsatisfactorily cut and patched.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect/Engineer of locations and details of cutting and await directions from Architect/Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to the following:
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Mechanical systems piping and ducts.
   f. Control systems.
   g. Communication systems.
   h. Fire-detection and -alarm systems.
i. Conveying systems.

j. Electrical wiring systems.

k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction exposed to the exterior or exposed in occupied spaces in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect/Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

5. Hazardous Materials: Do not proceed with cutting and patching operations until University has examined existing construction for the presence of asbestos and/or lead-based coatings. Comply with requirements in Section 01 35 00 “Special Procedures.”

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect/Engineer for the visual and functional performance of in-place materials.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work. Notify University Project Manager and Architect/Engineer and obtain approval prior to disturbing, moving or penetrating soil.

1. Arrange for locating buried utilities including water and sewer lines within construction limits. Obtain location information and stake all known utilities prior to commencing construction activities.
   a. Contact Utility Notification Center of Colorado (UNCC), 1-800-922-1987, and comply with UNCC guidelines.

2. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

3. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility or University, as appropriate, that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of
Contractor, submit a request for information to Architect/Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect/Engineer promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect/Engineer when deviations from required lines and levels exceed allowable tolerances. Record deviation which are accepted (i.e., not corrected) on record drawings in accordance with the requirements of Section 01 78 39 “Project Record Documents.”
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect/Engineer.

3.4 FIELD ENGINEERING

A. Identification: University will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect/Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect/Engineer before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated to the extent they are more explicit or stringent than requirements of the Contract Documents.

C. Install products at the time and under conditions, including weather that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Isolate each part of complete installation from incompatible material as needed to prevent deterioration.

E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

G. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

H. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

I. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned, true and level as applicable, with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

J. Attachment to Concrete:

1. No drilled inserts or powder-actuated fasteners are permitted in pre-stressed concrete except as specifically authorized by Contractor and carried out under the direct supervision of its Superintendent.
2. Only those devices with a maximum controlled penetration of 3/4 inch or less will be permitted. Make holes through slabs by means of sleeves placed no closer than 2 inch from tensioning cables. Core drilling will not be permitted unless unavoidable and as specified for cutting and patching in this Section.
K. Joints: Unless indicated otherwise, make joints of uniform width. Where joint locations in exposed work are required but not indicated, arrange joints for the best visual effect. Confirm arrangement with Architect/Engineer before proceeding. Fit exposed connections together to form hairline joints.

L. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Responsibility: Provide cutting and patching work, including attendant excavation and backfill required to complete the Work or to:

1. Make components fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work or work not conforming to requirements of Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

C. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

D. Temporary Support: Provide temporary support of work to be cut.

E. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

F. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

G. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

H. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations. Employ methods which will prevent settlement or damage to other work.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements, including tolerance, specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 UNIVERSITY-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for University's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by University's construction personnel.

   1. Construction Schedule: Inform University of Contractor's preferred construction schedule for University's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify University if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include University's construction personnel at preinstallation conferences covering portions of the Work that are to receive University's work. Attend preinstallation conferences conducted by University's construction personnel if portions of the Work depend on University's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   2. Do not hold waste materials more than seven calendar days during normal weather or three calendar days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.

B. Collection Point: Review location with University and obtain approval.

C. Site: Maintain Project site free of waste materials and debris.

D. Wind Blown Debris: Prevent spread of trash, debris, cartons, packing material, or other waste on or off Project site by wind.

E. Dust: Sprinkle dusty debris with water.

F. Packing Materials: Immediately after uncrating or unpacking materials or equipment, remove all crating, lumber, excelsior, wrapping or other like combustible materials from building to central collection facility.

G. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

H. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

I. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

J. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

K. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
L. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

M. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

N. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

O. Snow and Ice: Remove snow and ice from sidewalks adjacent to site and from access ways to building and construction site.

P. Streets: At frequency required by University and/or governing authority, clean adjacent and nearby streets of dirt resulting from construction operations.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
19. Electrical current.
20. High speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Misalignment.
25. Excessive weathering.
27. Improper shipping or handling.
28. Theft.
29. Vandalism.

END OF SECTION 01 73 00
SECTION 01 77 00
CLOSEOUT PROCEDURES

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures, including Notice of Completion and Final Inspection procedures.
2. Occupancy procedures, including Notice of Approval of Occupancy/Use and University Supplemental Notice of Occupancy and Use List.
3. Final Acceptance procedures, including Pre-Acceptance Checklist and University Supplemental Building/Project Acceptance List.
4. Inspections after completion.
5. Warranties.
6. Final cleaning.
7. Repair of the Work.

B. Related Requirements:

1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01 73 00 "Execution" for progress cleaning of Project site.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 79 00 "Demonstration and Training" for requirements for instructing University's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Notice of Completion.

C. Certified List of Incomplete Items: Final submittal at Final Acceptance.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.
1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 NOTICE OF COMPLETION AND SUBSTANTIAL COMPLETION PROCEDURES

A. Procedures and Submittals Prior to Notice of Completion: Complete and submit all of the following items prior to submitting Notice of Completion to Architect/Engineer. Include Contractor’s comprehensive list of items to be completed, corrected or not in compliance with the Drawings and Specifications.

1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's preliminary punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
2. Building Inspection Record: Submit completed record with all required corrections noted.
4. Final Completion Schedule: Submit schedule for performing and completing all work indicated on the Contractor’s list of incomplete items.
5. Submit sustainable design documentation.
6. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
7. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
8. Submit test/adjust/balance records.

B. Final Inspection: Submit Notice of Completion to Architect/Engineer. Upon receipt, Architect/Engineer and University will review and if all items on the University Supplemental Notice of Completion Checklist are complete will, within the timeframe required by the Contract, schedule and make an inspection of the Project to determine whether the Work is substantially complete.

1. Final Punch List: Based on the inspection, Architect/Engineer will prepare a final punch list of work to be completed, work not in compliance with the Drawings or Specifications, and unsatisfactory work for any reason.
2. Re-inspection: If the cumulative number of items identified on the final punch list prevents a determination that the work is substantially complete, complete those items and when complete resubmit Notice of Completion. Upon receipt of resubmittal, Architect/Engineer and University will then schedule and make a re-inspection of the Project to determine whether the Work is substantially complete.

C. Notice of Substantial Completion: When inspection of the Work indicates that the Project is substantially complete and all other Contract provisions required for substantial completion have been satisfied, Architect/Engineer will issue a Notice of Substantial Completion (State Form SBP-07).

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor or as approved by Architect/Engineer.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect/Engineer.
   d. Name of Contractor.
   e. Page number.

4. Submit list of incomplete items in the following format:
   a. MS Excel and PDF electronic file. Architect/Engineer will return annotated file.

1.8 OCCUPANCY PROCEDURES

A. Procedures and Submittals Prior to Occupancy: Complete and submit all items on both State Form SBP-01 “Notice of Approval of Occupancy/Use” and University Supplemental Notice of Occupancy and Use List.

1.9 FINAL ACCEPTANCE PROCEDURES

A. Procedures and Submittals Prior to Final Acceptance: Complete and submit all items on both State Form SBP-05 “Pre-Acceptance Checklist” and University Supplemental Building/Project Acceptance List.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 business days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect/Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.10 SETTLEMENT AND FINAL PAYMENT

A. Submit and complete all of the following as a condition precedent to settlement and final payment:
   1. All guarantees and warranties.
   2. All statement to support local sales tax refunds, if any.
   3. Three (3) sets of operation and maintenance manuals.
   4. One (1) set of as-built Contract Documents showing all job changes.
   5. All demonstration and training completed in accordance with Section 01 79 00.
   6. All punch list items documented as complete.

B. Final Certificate of Payment: Submit in accordance with the requirements of Section 01 29 00 “Payment Procedures.”
CLOSEOUT PROCEDURES  

CLOSEOUT PROCEDURES

1.11 INSPECTIONS AFTER COMPLETION

A. Warranty/Guarantee Inspections: During the warranty period, accompany Architect/Engineer and University Representative, and participate in inspection(s) of the Project to identify defective and deficient work at intervals and as required by the Contract.

B. List of Deficient or Defective Work: Within 10 business days of inspection, Architect/Engineer will provide Contractor with a list of items requiring correction.

C. Remedial Work: Upon receive of itemized list, immediately correct and remedy deficiencies and defects in a manner satisfactory to the Architect/Engineer and University.

1.12 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties to the Architect/Engineer prior to advertisement of the Notice of Contractor's Settlement. If the Notice of Acceptance designates a commencement date for warranties other than the date of Notice of Acceptance for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

B. Partial Occupancy: When a designated portion of the Work is completed and occupied or used by the University, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect/Engineer within fifteen (15) calendar days of completion of that designated portion of the Work.

C. Special Warranties: When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the University through the Architect/Engineer for approval prior to final execution. Refer to individual Specification Sections for specific requirements for special warranties.

D. Form of Submittal: Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Number of Copies: Two.
2. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
5. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

F. List of Extended Warranties: Provide a comprehensive list of all manufacturers’ standard and special warranties with duration greater than one year after Notice of Acceptance. Organize list into an orderly sequence based on table of contents of the Project Manual.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.
2. Do not use sweeping compounds on concrete floors that will leave residue affecting finish floor materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations immediately prior to Occupancy for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior finishes to a dirt-free condition, free of grease, dust, stains, films, fingerprints, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Power scrub and power buff resilient flooring surfaces, tile and fluid-applied flooring.
   k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   l. Remove labels that are not permanent.
   m. Wipe surfaces of mechanical and electrical equipment, elevator equipment where applicable, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.


q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

r. Clean food service equipment to sanitary condition acceptable for intended food service use and approved by authority having jurisdiction.

s. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

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

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

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

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

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

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

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.3 ATTACHMENTS

A. Samples of the following forms are appended to this Section for reference following End of Section 01 77 00:

1. University of Colorado Denver | Anschutz Medical Campus Supplemental Notice of Occupancy and Use List.

2. University of Colorado Denver | Anschutz Medical Campus Supplemental Building / Project Acceptance List.

END OF SECTION 01 77 00
**Supplemental Notice of Occupancy and Use List**

In addition to completing Notice of Approval of Occupancy / Use (SBP-01), the following items must be completed before Occupancy is approved.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date Completed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Final and formal address posted on the building entries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. A copy of the Contractor's in-progress red line &quot;as-built&quot; drawings has been given to BMO representative &amp; a 2nd copy is provided for Projects plan room. This is to include landscape drawings showing irrigation installation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Maintenance, operations and spare parts manuals on all installed equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Notice of Partial Substantial Completion concerning roles/ responsibilities of University and Contractor for security, maintenance, heat, utilities reviewed and accepted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Manufacturer maintenance, operations and spare parts manuals for fixtures, mechanical, electrical and plumbing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Hardware maintenance, operations and spare parts manuals for doors &amp; locks, including roll up doors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Warranty Dates and Contact list for all Contractors and Suppliers given to BMO.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Transfer utility account from Contractor to Facilities Operations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Site plan to include first floor main isolation locations and plans for each floor to include main utility shutoffs, for utilities to include water, electrical, steam, sewer, fuel supply, telecom, fiber optic and gasses, identified on a set of drawings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. If Commissioning Report is completed, BMO has reviewed/ commented, including electrical, plumbing, mechanical/ HVAC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. All Contractor provided equipment has new filters &amp; construction filters removed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Not Used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Elevator equipment rooms insulated and space conditioned for control system requirements.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. FSS has been provided with copy of Building Department testing and inspection report for window washing equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Roof walking pads to access equipment are installed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. PM to communicate to fire department via Life Safety Officer that building has transitioned to BMO. Alarms at Anschutz Medical Campus report to University Police Dispatch and at Downtown report to designated monitoring company.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Training for BMO and FSS on installed equipment and systems is completed.

20. Equipment keys and locks transitioned to Operations, including fire panels, electrical panels, directories and generator panels. Construction cores removed and replaced with permanent cores.

21. Access control pathways and junction boxes for installed doors, gates, loading docks and roof access complete. *All wiring and hardware completed and electronic security access controls in place and tested by University Electronic Security.*

22. EH&S is provided, as applicable for project, with fume hood certification, water testing certification, hazardous waste compliance certification, radiation compliance certification, BSL3 certification, and all other specialty equipment certification.

23. PM notifies University Risk Management that project is transferring to University and notifies Contractor that it can eliminate Builders Risk Insurance.

24. Not Used

25. Not Used

26. Elevator tools, including hand tools, computer, proprietary and operational software is received and confirm 1-year service from date of acceptance.

27. All computers and software required in drawings and specs. are received, including for BAS, Energy and Lighting, Fuel Systems, and Power Management, and any specialty software and alarm codes for operating systems.

28. For all areas to be transferred to University, all waste and debris removed; floor and wall surfaces clean and in good repair; ceiling surfaces clean, unmarked, in place; site, including sidewalks, cleared of debris and construction equipment; and roof is clear of all materials and debris.

29. Water chlorination and testing complete and provided by PM to Chief Building Official and BMO via BMO Rep.

30. Toilet accessories are in place that meet custodial contract.

31. Trash receptacles outside the building are in place

---

**University Project Manager**

(sign & print name)  Date  **University BMO Rep.**

(sign & print name)  Date

**University FSS Rep**

(sign & print name)  Date  **University Downtown Rep. (If Necessary)**

(sign & print name)  Date

*Highlighted items are not the responsibility of Contractor but PM and BMO Rep must ensure these are completed and operational prior to occupancy and use.*

Mark N/A by item if it is not applicable to project

3.1.12

---

2 Modified per Addendum 2
SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Systems, subsystems, and equipment operation and maintenance manuals.
3. Product maintenance manuals.
4. Emergency manuals.
5. Framed operating and maintenance instructions.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Schedule: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.

1. Correct or revise each manual to comply with Architect/Engineer's comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer's comments and prior to commencing demonstration and training.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect/Engineer.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

   b. Compile entirely from documents with searchable text.

   c. Enable inserted reviewer comments on draft submittals.

2. Paper copies. Assemble in accordance with the requirements of this Section.
a. Submit three final copies, one to be retained by the Architect/Engineer and two to be retained by the University.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.

1. Correct or revise each manual to comply with Architect/Engineer's comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Intent: Prepare data in form of an instructional manual for use by University personnel.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of University.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect/Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect/Engineer that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item
using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

G. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

H. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in minimum 1 inch and maximum 2 inch thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.


5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 SYSTEMS, SUBSYSTEMS AND EQUIPMENT OPERATION AND MAINTENANCE MANUALS

A. General: Provide operation and maintenance manuals where indicated in individual Specification Section and the following:

1. Heating, ventilating and air-conditioning equipment and systems.
2. Plumbing equipment and systems.
3. Special piping equipment and systems.
4. Electrical distribution systems.
5. Standby generator systems.
6. Communications systems.
7. Fire alarm and detection systems.
B. Operation Content: In addition to requirements in this Section, include operation data required in individual Specification Sections.

1. Additional Operation Content Required:
   b. Performance and design criteria if Contractor has delegated design responsibility.
   c. Operating standards.
   d. Operating procedures.
   e. Operating logs.
   f. Wiring diagrams.
   g. Control diagrams.
   h. Piped system diagrams.
   i. Precautions against improper use.
   j. License requirements including inspection and renewal dates.

2. Descriptions: Include the following:
   a. Product name and model number. Use designations for products indicated on Contract Documents.
   b. Manufacturer's name.
   c. Equipment identification with serial number of each component.
   d. Equipment function.
   e. Operating characteristics.
   f. Limiting conditions.
   g. Performance curves.
   h. Engineering data and tests.
   i. Complete nomenclature and number of replacement parts.

3. Operating Procedures: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Normal shutdown instructions.
   g. Seasonal and weekend operating instructions.
   h. Required sequences for electric or electronic systems.
   i. Special operating instructions and procedures.

4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.


C. Maintenance Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

1. Source Information: Provide the following information in a list for each product included in manual:
2. Name, address, and telephone number of Installer or supplier and maintenance service agent.
   b. Name, address, and telephone number of local source for supply of replacement parts.
   c. Name, address, and telephone number of maintenance contractor, where appropriate.
   d. Cross-reference Specification Section number and title.
   e. Drawing or schedule designation or identifier where applicable.

2. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation
   including the following information for each component part or piece of equipment:
   a. Standard maintenance instructions and bulletins.
   b. Drawings, diagrams, and instructions required for maintenance, including disassembly and
      component removal, replacement, and assembly.
   c. Identification and nomenclature of parts and components.
   d. List of items recommended to be stocked as spare parts.

3. Maintenance Procedures: Include the following information and items that detail essential
   maintenance procedures:
   a. Test and inspection instructions.
   b. Troubleshooting guide.
   c. Precautions against improper maintenance.
   d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   e. Aligning, adjusting, and checking instructions.
   f. Demonstration and training video recording, if available.

4. Maintenance and Service Schedules: Include service and lubrication requirements, list of required
   lubricants for equipment, and separate schedules for preventive and routine maintenance and
   service with standard time allotment.
   a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly,
      quarterly, semiannual, and annual frequencies.
   b. Maintenance and Service Record: Include manufacturers' forms for recording
      maintenance.

5. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts
   identified and cross-referenced to manufacturers' maintenance documentation and local sources of
   maintenance materials and related services.

6. Maintenance Service Contracts: Include copies of maintenance agreements with name and
   telephone number of service agent.

7. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and
   conditions that would affect validity of warranties or bonds.
   a. Include procedures to follow and required notifications for warranty claims.
   b. Include information sheet covering proper procedures in event of failure and instances
      which might affect validity of warranties and bonds.

2.3 PRODUCT MAINTENANCE MANUALS

   A. Content: Organize manual into a separate section for each product, material, and finish. Separate into
      two manuals: one for exterior moisture protection products and those exposed to weather and one for
      interior products. Include source information, product information, maintenance procedures, repair
      materials and sources, and warranties and bonds, as described below.
B. Source Information: Provide the following information for each product included in manual:

1. Name, address, and telephone number of Installer or supplier and maintenance service agent.
3. Drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.4 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
5. Power failure.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of University's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.5 FRAMED OPERATING AND MAINTENANCE INSTRUCTIONS

A. All mechanically and electrically operated equipment and controls shall be provided with legible and complete wiring diagrams, schematics, operating instructions, and pertinent preventative maintenance instructions in a sturdy frame with clear glass or plastic cover. Use non-fading, permanent media.

B. Locate frames in the same room or service enclosure as equipment, or in the nearest mechanical or electrical room.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23
SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Record Samples.
5. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. General: Submit record drawings with duplicate original transmittal letters containing:

1. Date.
2. Project title and number.
3. Contractor’s name and address.
4. Certification that each document as submitted is complete and accurate.
5. Signature of authorized representative of the Contractor.

B. Record Drawings: Submit copies of record Drawings as follows:

1. Submit three paper-copy sets of marked-up record prints, two copies will be retained by the University and one copy retained by the Architect/Engineer.
2. Submit three paper-copy sets and three digital copies on CD of electronic files for all delegated-design submittals. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

C. Record Specifications: Submit three paper copies of Project's Specifications, including addenda and contract modifications. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

D. Record Product Data: Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.
f. Mark using line types and symbols conforming to Contract Documents.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities referenced to permanent surface improvements.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities referenced to visible and accessible features of structure.
j. Locations of concealed valves, dampers, controls, balancing devices, junction boxes, cleanouts, and other items requiring access or maintenance.
k. Changes made by Change Order.
l. Changes made following Architect/Engineer’s written orders.
m. Details not on the original Contract Drawings.
n. Field records for variable and concealed conditions.
o. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark additional information important to University that was either shown schematically or omitted from original Drawings.

6. Note Change Order numbers, and similar identification, where applicable.
B. Record Delegated Design Electronic Files: For all delegated design submittals, including but not limited to landscape irrigation, fire alarm and fire sprinkler plans, prepare electronic files in full compliance with University of Colorado Denver | Anschutz Medical Campus Guidelines and Design Standards, Part 1.0, Paragraph “Drawing Production Standards.”

C. Identification: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

   1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect/Engineer.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

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

   1. Give particular attention to substitutions, selection of options, and similar information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Note related Change Orders where applicable.
   4. Maintain one complete copy of all Addenda, Change Orders and other written change documents in printed form during construction.

2.3 RECORD PRODUCT DATA

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

   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Directory: Include record Product Data directory organized by Specification Section number and title.

C. Product List: Update and record any changes to Product List submitted in accordance with Section 01 60 00 “Product Requirements”, including any changes to brand, model, subcontractor, or Installer so that final list reflects materials, equipment and systems incorporated into the Work.
2.4 RECORD SAMPLES

A. Prior to Final Acceptance, meet with University Project Manager and Architect/Engineer at site to review and identify which submitted samples maintained during the progress of the Work are to be transmitted to the University.

B. Deliver selected samples to storage area identified by University.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1. Include manufacturer’s certifications, field test record, copies of permits, licenses, certifications, inspection reports, releases, notices, receipts for fee payments and similar documents.

B. Directory: Include miscellaneous record submittals directory organized by Specification Section number and title.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project. Update at least weekly.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect/Engineer's and University's reference during normal working hours.

END OF SECTION 01 78 39
SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused or recycled.

B. Related Sections:
   1. Division 01 Section "Indoor Air Quality Procedures".
   2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   3. Division 01 Section "Photographic Documentation" for pre-demolition photographs.
   4. Division 01 Section "Execution" for cutting and patching procedures.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 ACTION SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building managers and other tenants' on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Locations of proposed dust-and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
   6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
   7. Means of protection for items to remain and items in path of waste removal from building.
B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Pre-demolition Photographs or Video Recordings: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations.

1.04 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.05 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 01 Section "Summary".

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Will be identified by Owner's asbestos consultant on walk through with contractor to identify test areas for asbestos removal.

1. If unsuspected materials containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. Storage or sale of removed items or materials on-site is not permitted.
F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire protection facilities in service during selective demolition operations.

1.06 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs and preconstruction video tapes plates.
   1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
   2. Comply with requirements specified in Division 01 Section "Photographic Documentation."

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary".

C. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off indicated utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that by pass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after by passing.
      a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Division 01 Sections "Temporary Facilities and Controls".

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Comply with requirements for protection of existing ductwork and air distribution system as specified in Division 01 Section "Indoor Air Quality Procedures".

SELECTIVE DEMOLITION
02 41 19 - 4
3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limit at ions of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimized disturbance of adjacent surfaces. Temporarily cover openings to remain.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared off flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppress ion devices during flame-cutting operations.

4. Maintain adequate ventilation when using cutting torches.

5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

6. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.

5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4-inch at junctures with construction to remain, using power driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

C. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.06 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstall, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION
SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. General requirements for all Division 23 sections
   2. Piping materials and installation instructions common to most piping systems
   3. Access Panels
   4. Identification
   5. HVAC demolition
   6. Equipment installation requirements common to equipment sections
   7. Painting and finishing
   8. Supports and anchorages

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

B. All electrical work installed under Division 23 shall be in compliance with Division 26.

1.03 DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic in character indicating design concept and do not indicate every required duct or piping offset, valve, fitting, etc.

B. All drawings relating to this structure, together with these specifications, shall be considered in bidding and construction. The drawings and specifications are complementary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict or omissions arise between the drawings and specifications, such conflict shall be brought to the attention of the Architect/Engineer for resolution.

C. Unless otherwise indicated, all equipment and performance data listed is for job site conditions (elevation 5300 feet).

D. Drawings are not to be scaled.

1.04 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical 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 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 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.

F. The following are industry abbreviations for plastic materials:
   1. CPVC: Chlorinated polyvinyl chloride plastic
   2. PE: Polyethylene plastic
   3. PVC: Polyvinyl chloride plastic

G. The following are industry abbreviations for rubber materials:
   1. EPDM – Ethylene propylene diene terpolymer rubber
   2. NBR – Acrylonitrile-butadiene rubber

1.05 SUBMITTALS

A. Division 23 Submittal Data and Shop Drawings:
   1. Refer to Division 1, for general submittal requirements.
   2. Contractor agrees that shop drawings and/or submittals processed by the Engineer are not change orders; that the purpose of shop drawings and/or submittals by the Contractor is to inform the Engineer which equipment and materials he intends to furnish and install.
   3. Submittals and/or shop drawings are to be edited to show specific data and all options for the HVAC equipment that the Contractor intends to provide.
   4. Submittals and/or shop drawings are to be identified with numbers or letters identical to those listed on the drawings and/or specifications.
   5. All shop drawings for special systems (temperature controls, etc.) that will become permanent record documents shall be prepared on AutoCAD Version 2007 or later, using the same drawing size as the project construction documents.
   6. Approved Manufacturers and Substitutions
      a. Equipment and/or materials manufactured by any one of the Engineer-approved manufacturers listed in this specification or on the drawings shall be acceptable if the equipment and material is equivalent in performance, capacity, and configuration.
      b. Substitution Requests prior to bid: Refer to Division 1. No prior approvals will be given by the Engineer unless specifically mentioned in these specifications.
      c. Substitution Requests after Execution of Contract: If Contractor wishes to furnish or use a substitute item of material and/or equipment, he must submit a change order request to the Engineer. The request for change order shall itemize each of the proposed substitutions identified by applicable specification section, paragraph number, and/or drawing number. A price change (increase or decrease) shall be listed for each item along with complete data showing performance over entire range, physical dimensions, electrical characteristics, material construction, operating weight, and other applicable data. Justification of substitution must be more than just cost justification. The Engineer will review the change order request for equality, suitability, and reasonableness of price differential. A single substitution change order listing the approved items will be issued with the net cost of the change order being the sum of the approved item costs. No subsequent substitution change orders will be considered. The Engineer’s decision will be final.
      d. It shall be the responsibility of the Contractor to assure that the substitute material and/or equipment fits into the space provided and the Contractor shall pay for all extra costs incurred by other trades for any and all changes necessitated by these substitutions. No time extension will be allowed due to substitution on equipment.
e. Equipment and/or materials manufactured by any one of the Engineer-approved manufacturers listed in this specification or on the drawings shall be acceptable if the equipment and material is equivalent in performance, capacity, and configuration.

7. Submittals Schedule:
   a. Comply with Division 1 construction progress documentation and submittal requirements and the additional submittal requirements specified below. Unless otherwise specified in Division 1, comply with the submittal periods specified below. Engineer will schedule submittal reviews based upon submittal schedule. Failure to submit schedule may result in inability to review submittals within the periods stated in the submittal schedule. These delays shall not be cause for extension of Contact completion date.

   1) Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

   2) Submit schedule within 14 days of commencement of work. Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

   3) Allow 15 days for review of each resubmittal.

   4) Submit a minimum of three copies of schedule. Arrange the following information in a tabular format:
      a) Scheduled date for first submittal.
      b) Specification Section number and title.
      c) Submittal category (action or informational).
      d) Name of subcontractor.
      e) Description of the Work covered.
      f) Scheduled date for Architect's final release of reviewed submittal.

8. Schedule of Deviations
   a. Equipment and material submittals of approved manufacturers, including basis of design manufacture shall provide a written itemization of exceptions to the specification and deviations from the basis of design for all features, design, configuration, physical dimension, performance, and operation of the submitted product. Those elements not identified and itemized as exceptions in the submittal shall not be reviewed by the Engineer and shall be provided as specified.

B. Close-out Submittals:
   1. Operating and Maintenance (O&M) Manual:
      a. Provide O&M manuals in accordance with Division 1.
      b. The Contractor shall prepare an operating and maintenance manual that shall cover all systems and equipment installed under this Division. Incorporate the standard technical literature into system-specific formats for this facility as designed and actually installed. The resulting manual shall also serve as the training manual and shall be specific, concise, to the point, and tailored specifically for this facility.
      c. Unless specified otherwise in Division 1, the maintenance manual shall be submitted to the Engineer in draft form for approval prior to preparation of two copies for final submission to the Architect for delivery to the Owner.
      d. The maintenance manual shall be 8-1/2” x 11” size and assembled in loose-leaf three-ring or post binder. Provide manufacturers’ original literature. Facsimiles are not acceptable. The manual shall be adequately indexed and contain the following information:
         1) Contractors’ names, addresses, and telephone numbers
         2) Alphabetical list of all system components with the name and address and 24-hour phone number of the company responsible for servicing each item during the first year of operation
3) Guarantees and warranties of all equipment whenever applicable.
4) All manufacturers’ data that is applicable to the installed equipment, with appropriate
highlighting, such as the following:
a) Shop drawings (latest copy)
b) Installation instructions
c) Lubrication instructions
d) Wiring diagrams
5) A simplified description of the operation of all systems including the function of each
piece of equipment within each system. Including both normal and emergency
operation. These descriptions shall be supported with a schematic flow diagram when
applicable.

2. Record Drawings
   a. Comply with record drawing requirements in Division 1.
   b. Record Prints
      1) All RFIs, change orders and other directives if not recorded on the contract drawings
         and amendments shall be red-lined on the record drawings. Record drawings simply
         tabulating the amendments onto the drawings shall be returned for clarification of
         installed conditions and red-line mark-up.

C. Non-Responsive Submittals: Submittals are intended to be reviewed in an initial submittal with
comments corrected and submitted in a resubmittal. Non-responsiveness to the initial submittal
comments in the resubmittal will result in return of the documents for correction and additional
resubmittals. Any time charged by the Engineer in review of additional resubmittals due to non-
responsiveness shall be deducted from the Contractor's billings.

D. Product Data: for the following:
   1. Transition fittings
   2. Dielectric fittings
   3. Mechanical sleeve seals
   4. Escutcheons
   5. Motor Submittal Data: The following data shall be submitted for all motors:
      a. Full load current and service factor running current at operating voltage.
      b. Locked rotor current, starting power factor, and power factor at full load.
      c. Efficiency at full load.
      d. Data to substantiate Class F insulation with Class B rise at 100% load.
      e. Full load speeds (rpm).
      f. Enclosure type (ODP, TEFC, explosion proof, TENV, WPI, etc.)
      Note: All tests (except locked rotor current) shall be made at full voltage and rated frequency.
   6. Motor Controllers:
      a. Torque, speed, and horsepower requirements of the load.
      b. Ratings and characteristics of supply circuit and required control sequence.
      c. Ambient and environmental conditions of installation location.
   7. Capacitor size (KVAR) for maximum power factor correction at 95% lagging.
   8. Identification: Submit product for each type of identification.

E. Certification:
   1. Welding certificates
   2. Certificates of Compliance for all Designated Seismic Systems.

F. Schedules:
   1. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed
      content for each label.
   2. Valve numbering scheme.
   3. Valve Schedules: For each piping system to include in maintenance manuals.
1.06 QUALITY ASSURANCE

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

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of lower or higher electrical characteristics may be furnished provided such proposed equipment variations are specifically identified as a deviation from contract documents and approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no cost to the Owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support piping to prevent sagging and bending.

1.08 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8.

D. Identification:
   1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
   2. Coordinate installation of identifying devices with locations of access panels and doors.
   3. Install identifying devices before installing acoustical ceilings and similar concealment.

E. Coordinate with all trades to maintain clearances to access panels, equipment, control and electrical panels. Intrusions into access space shall be brought to the attention of other trades. Notify Engineer of conflicts shown on drawings prior to installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Subject to compliance with requirements, provide products by the manufacturers specified.
2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 HVAC piping Sections for pipe, tube, and fitting materials and joining methods.
   1. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 23 HVAC piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 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 Unions: Use dielectric couplings.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig (1035 or 2070 kPa) minimum working pressure as required to suit system pressures.
   1. Available Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company
      c. Epco Sales, Inc.
      d. Watts Industries, Inc.; Water Products Division

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Available Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Central Plastics Company
      d. Pipeline Seal and Insulator, Inc.
   2. Separate companion flanges and steel bolts and nuts shall have 150 or 300 psig (1035 or 2070 kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300 psig (2070 kPa) minimum working pressure at 225°F (107°C).
   1. Available Manufacturers:
      a. Calpico, Inc.
      b. Lochinvar Corp.
2.05 MISCELLANEOUS ELECTRICAL DEVICES

A. Furnish all necessary control devices such as speed controls, transformers, and relays as required for proper operation of all equipment furnished under this Division.

B. Furnish all remote switches and/or pushbutton stations required for manually operated equipment complete with low energy pilot lights of an approved type.

C. Enclosures: NEMA Type 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA Type 4 with conduit hubs, or units in hazardous locations that shall have NEC proper class and division explosion proof enclosure.

D. Furnish circuit and purpose identification for each remote manual switch and/or pushbutton station furnished herein. Identification may be either engraved plastic sign for permanent mounting to wall below switch, or stamping on switch coverplate. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate area.

2.06 ACCESS PANELS OTHER THAN SHEET METAL

A. Refer to Division 8 for specification of access doors.

2.07 IDENTIFICATION

A. Equipment Labels:

1. Metal Labels for Equipment:
   a. Material and Thickness: Brass, 0.032-inch (0.77 mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (65 by 20 mm).
   c. Minimum Letter Size: 1/4 inch (6 mm) for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   d. Fasteners: Stainless steel rivets or self-tapping screws.
   e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2. Plastic Labels for Equipment:
   a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
   c. Background Color: Black or blue.
   d. Maximum Temperature: Able to withstand temperatures up to 160°F (71°C).
   e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch (65 x 20 mm).
   f. Minimum Letter Size: 1/4 inch (6 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (15 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   g. Fasteners: Stainless steel rivets or self-tapping screws.
   h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

3. Label Content: Include equipment's unique equipment number.

4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2" x 11" (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
B. Pipe Labels:
1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
2. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
4. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
5. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   b. Lettering Size: At least 1-1/2 inches (40 mm) high.

C. Duct Labels:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160°F (71°C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 4 x 12 inch (100 x 300 mm).
6. Minimum Letter Size: 2 inch (50 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
9. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
   a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
   b. Arrow Size: At least 6 inches (150 mm) high.

D. Stencils:
1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 2 inches (50 mm) for ducts; and minimum letter height of 3/4 inch (20 mm) for access panel and door labels, equipment labels, and similar operational instructions.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Exterior, gloss enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

E. Valve Tags:
1. Valve Tags: Stamped or engraved with 1/4-inch (6 mm) letters for piping system abbreviation and 1/2-inch (15 mm) numbers.
   a. Tag Material: Brass, 0.032-inch (0.77 mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   b. Fasteners: Brass wire-link or beaded chain; or S-hook.
2. Valve Schedules: For each piping system, on 8-1/2" x 11" (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   a. Valve-tag schedule shall be included in operation and maintenance data.
PART 3 – EXECUTION

3.01 HVAC DEMOLITION

A. Refer to Division 1 and Division 2 for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.

C. 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.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying HVAC 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 according to the following:
1. New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: Split, cast-brass type with spring clips.
d. Bare Piping at Wall, Floor, and Ceiling Penetrations in Finished Spaces, Unfinished Service Spaces, and Equipment Rooms: One-piece or split, cast-brass type with polished chrome-plated finish.

2. Existing Piping: Use the following:
   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split, cast-brass type with spring clips.
   c. Bare Piping at Wall, Floor, and Ceiling Penetrations in Finished Spaces, Unfinished Service Spaces, and Equipment Rooms: Split, cast-brass type with polished chrome-plated finish.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
   Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 for materials and installation.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials listed for application. Refer to Division 7 for firestopping materials.

P. Verify final equipment locations for roughing-in.

Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

R. Install dielectric fittings or approved adaptor fittings on all joints between different piping materials on steam, hot water, chilled water, condenser water, steam condensate, ground source heat pump loop systems and other hydronic mechanical piping systems.

S. Old Pipe Lines: If any old sewer, water, gas, or other pipes are encountered that interfere with the proper installation of new work and that will not be used in connections with the new work, close all openings in proper manner or, if necessary, relocate or remove the pipes as shown on plans. Should any old pipes and/or electrical lines not shown on plans be encountered, immediately notify Owner’s representative before taking any action.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 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.

COMMON WORK RESULTS FOR HVAC
23 05 00 - 10
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.


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. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D2846 (D2846M) Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

3.04 ACCESS PANELS
A. Furnish access panels where required for access to concealed HVAC items such as dampers, valves, strainers, shock absorbers, cleanouts, control devices, and where required for equipment servicing.

B. Deliver all panels to General Contractor for installation. Provide instructions for their location in sufficient time so panels can be installed in the normal course of work.

3.05 IDENTIFICATION COMMON REQUIREMENTS
A. Provide pipe identification, valve tags, stencils, or engraved name plates to clearly identify all mechanical equipment, including motors, piping and controls of the various mechanical systems and direction of flow in piping.

B. Plastic Pipe Markers
   1. On bare pipe when surface temperature exceeds 180 degree F provide a 1-inch thick insulation band under marker for protection from the hot pipe.

C. Piping, Ducts, and Equipment Identification:
   1. Piping:
      a. Identify all piping accessible for maintenance in crawl spaces, tunnels, above ceilings, and access spaces as well as exposed to view utilizing stenciled markings according to the following procedures:
1) Use an arrow marker for each pipe-content legend. The arrow shall always point away from the pipe legend and in the direction of flow. Color and height of arrow to be same as content legend lettering.

2) If flow can be in both directions, use a double-headed arrow indication.

3) Apply pipe legend and arrow indication at every point of pipe entry or exit where line goes through wall or ceiling cut.

4) Apply pipe legend and arrow indication within 3 inch of each valve to show proper identification of pipe contents and direction of flow.

5) Apply legend to the pipe so that lettering is in the most legible position. For overhead piping, apply legend on the lower half of the pipe where view is unobstructed, so that legend can be read at a glance from floor level.


7) Legend on steam piping, condensate return, compressed air, gas, and vacuum systems: Include working pressure or vacuum.

2. Valves:
   a. System service valves located inside the building: Tag and identify as to type of service.
   b. Valves or cocks controlling branch mains or risers to various portions of the building: Tag and identified as to service and location.

3. Controls:
   a. Magnetic starters and relays: Install nameplates or stencil to identify connecting or controlled equipment.
   b. Manual operating switches, fused disconnect switches and thermal over-load switches which have not been specified as furnished with indexed face plates: Install nameplates or be stencil as to controlled equipment.
   c. Automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays, and starters: Clearly identified with unit served and function.
   d. Identify all starters, disconnect switches, and manually operated controls, except integral equipment switches with nomenclature corresponding to operating instructions in the "Operation and Maintenance Manual". Coordinate with the university Facilities Operations personnel through the university Project Manager.

4. Fans:
   a. Label exhaust fans, air handling units and connecting ductwork supplying one or more areas from an equipment room or isolated crawl or furred space. Install nameplate or stencil as to plan code number, service and areas or zones served.

5. Pumps:
   a. Identify as to service and zones served.
   b. Install nameplate or stencil system served on base mounted pumps.
   c. Install brass tags secured by tie wires on small in-line pumps.

6. Storage Tanks, Water Treatment Equipment and Heaters:
   a. Stencil service on tanks and heaters
   b. Label connecting pipes and indicate the service temperature entering and leaving the tank or heater.

7. Air Conditioning Equipment:
   a. Equipment such as chillers, pumps, condensers, or rooftop equipment: Identified by stencils, or system nameplates. Labels of remote equipment shall also indicate the space(s) being served and the location of their electrical breaker (Panel ID, Room No. And Circuit).
   b. Identify locations of air handling devices which have filters and are above accessible ceilings by a blue circular dot or tack at least 3/4 inch in diameter, or embossed tape, adhered to the nearest T-bar.
8. Access Doors:
   a. Provide engraved nameplates or painted stencils to identify concealed valves, controls, dampers or other similar concealed mechanical equipment.
   b. Identify the locations of fire dampers above accessible ceilings with a red circular dot at least 3/4 inch in diameter, or embossed tape, adhered to the nearest T-bar. Access door shall be painted red.
   c. Obtain the university Project Manager’s approval before installation on all access doors in finished areas.

9. Lift-Out Ceilings:
   a. Provide engraved nameplates on ceiling tee stem (screwed or riveted, adhesive not allowed) to identify concealed valves, VAV boxes, filters, fire/smoke dampers or similar concealed mechanical equipment that is directly above nameplate in ceiling space.
   b. Obtain the University Project Manager’s approval of tag locations before installation.

10. Terminal Units:
    a. Identify all units with unique numbers corresponding to the drawings, and indicate the space being served.
    b. Use engraved plastic laminate labels affixed to each box by screws or rivets.

D. Piping Label Tags

<table>
<thead>
<tr>
<th>Classification</th>
<th>Color of Field</th>
<th>Letter Colors</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Inherently Hazardous:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable or Explosive:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Yellow</td>
<td>Black</td>
<td>NG</td>
</tr>
<tr>
<td>Lab Waste</td>
<td>Yellow</td>
<td>Black</td>
<td>AW</td>
</tr>
<tr>
<td>Extreme Temperatures or Pressures:</td>
<td>Yellow</td>
<td>Black</td>
<td>Dom HW</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Yellow</td>
<td>Black</td>
<td>Dom HWC</td>
</tr>
<tr>
<td>Domestic Hot Water, Circulating</td>
<td>Yellow</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Heating Water Supply</td>
<td>Yellow</td>
<td>Black</td>
<td>HWS</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>Yellow</td>
<td>Black</td>
<td>HWR</td>
</tr>
<tr>
<td>Low Pressure Steam</td>
<td>Yellow</td>
<td>Black</td>
<td>LPS</td>
</tr>
<tr>
<td>Low Pressure Steam Condensate</td>
<td>Yellow</td>
<td>Black</td>
<td>LPSC</td>
</tr>
<tr>
<td>High Pressure Steam</td>
<td>Yellow</td>
<td>Black</td>
<td>HPS</td>
</tr>
<tr>
<td>High Pressure Steam Condensate</td>
<td>Yellow</td>
<td>Black</td>
<td>HPSC</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>Yellow</td>
<td>Black</td>
<td>REF</td>
</tr>
<tr>
<td>High Pressure Compressed Air (over 90 psig)</td>
<td>Yellow</td>
<td>Black</td>
<td>CA</td>
</tr>
<tr>
<td>Materials of Inherently Low Hazard:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or Liquid Admixture:</td>
<td>Green</td>
<td>White</td>
<td>DW</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>Green</td>
<td>White</td>
<td>Dom CW</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>Green</td>
<td>White</td>
<td>SAN</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>Green</td>
<td>White</td>
<td>V</td>
</tr>
<tr>
<td>Waste Vent</td>
<td>Green</td>
<td>White</td>
<td>CWS</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>Green</td>
<td>White</td>
<td>CWR</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>Green</td>
<td>White</td>
<td>CS</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Green</td>
<td>White</td>
<td>CS</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Green</td>
<td>White</td>
<td>CR</td>
</tr>
</tbody>
</table>

COMMON WORK RESULTS FOR HVAC
23 05 00 - 13
<table>
<thead>
<tr>
<th>Classification</th>
<th>Color of Field</th>
<th>Letter Colors</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas or Gaseous Admixture:</td>
<td>Blue</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Medium Pressure Compressed Air (30 to 90 psig)</td>
<td>Blue</td>
<td>White</td>
<td>CA</td>
</tr>
<tr>
<td>Low Pressure Compressed Air (less than 30 psig)</td>
<td>Blue</td>
<td>White</td>
<td>CA</td>
</tr>
<tr>
<td>Vacuum</td>
<td>White</td>
<td>Black</td>
<td>VAC</td>
</tr>
<tr>
<td>Fire Quenching Materials:</td>
<td>Red</td>
<td>White</td>
<td>FL</td>
</tr>
</tbody>
</table>

E. Mechanical Equipment Naming Strategy:
1. Equipment identification numbers may be up to 32 characters. Equipment naming strategy is:
   System – Bld – Number
   ####-####-##-####
2. The first three placeholders are reserved for the system designation (alpha characters)
3. The fourth character is a hyphen.
4. The fifth through ninth placeholders are reserved for the building designation (alpha and/or numeric)
5. The tenth character is a hyphen
6. The eleventh through sixteenth placeholders are a “smart number.” It is composed of a two-digit, alpha or numeric, floor location designator followed by a hyphen and a three digit numeric sequential indicator.
7. The seventeenth character is a hyphen
8. In some instances the point name will be followed by a hyphen and a sub-point name
9. All device and point names will be assigned by the Facilities Operations, Building Operations Department.
10. All references to equipment and devices in drawings, labels, equipment tags, BAS system, etc., must use this naming convention.
11. Equipment designation, for prints may exclude the building designator.

3.06 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 9 for interior painting and exterior painting.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 for structural steel

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.
A. Cleaning and Flushing:
1. All water circulating systems for the project shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil, and any and all other material foreign to the water being circulated.
2. Extreme care shall be exercised during construction to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped, and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting, or valve shall be visually examined and all dirt removed.
   a. Heating Water Systems: Hot water heating systems, including converters, pumps, coils, and piping shall be cleaned with a solution of trisodium phosphate. This cleaning also applies to glycol systems prior to filling. Apply heat while circulating, slowly raising system to design temperature; maintain for a minimum of 24 hours. Remove heat and allow to cool; drain, and refill with clean water. Circulate for 6 hours at design temperature, then drain. Refill with clean water and repeat until system cleaner is removed.
3. After the system (or portion thereof) has been leak tested, thoroughly flush with clean water. During the clean water flush, all valves shall be full open, the flow rate for flush shall be at least 4 ft./sec., and the total flow shall equal at least five times the total piping system volume. Flushing shall continue until water runs clear.
4. After clear water flushing is complete, a chemical flushing solution, shall be utilized to remove oil, grease, piping compounds, etc. After the system is filled with this solution, the system shall be brought up to temperature and allowed to circulate for at least eight hours. The system shall then be drained completely and refilled with fresh water.
5. After the system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side (pH = 7.5+). If the system is found to be still on the acid side, the chemical flush shall be repeated as necessary.
6. The Owner's representative shall be given notice of this cleaning operation. If the Owner's representative deems it necessary, the cleaning operation shall be repeated.
7. "Stop-Leak" compounds shall not be added to the system at any time.
8. Immediately after clear water flushing is complete, a chemical corrosion inhibitor solution, as furnished by the Division 23 Section "Water Treatment," Vendor/Contractor, shall be utilized to initially treat the system.
9. Clean exterior of piping prior to application of coatings.

B. Cleanup:
1. Clean coils and plenums.
2. Clean under, in and around equipment.
3. Clean exposed surfaces of ducts, piping, and equipment.
4. Clean equipment cabinets and enclosures.
5. Provide all new filters for equipment.

END OF SECTION
SECTION 230523

GENERAL DUTY VALVES FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following general-duty valves:
   1. Bronze ball valves
   2. Eccentric balancing valves

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.03 DEFINITIONS

A. The following are standard abbreviations for valves:
   1. CWP: Cold working pressure
   2. EPDM: Ethylene-propylene-diene terpolymer rubber
   3. PTFE: Polytetrafluoroethylene plastic
   4. SWP: Steam working pressure
   5. TFE: Tetrafluoroethylene plastic

1.04 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.05 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for valves up to 125 psig and ASME B31.1 valves above 125 psig.
B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
C. NSF Compliance: NSF 61 for valve materials for potable-water service.
D. Source Limitations: Obtain valves of a single type through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set ball and plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

E. Valve Actuators:
   1. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.

F. Extended Valve Stems: On insulated valves.

G. Valve Ends:
      a. Caution: Use solder with melting point below 840°F for angle, check, gate, and globe valves; below 421°F for ball valves.
      b. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSSSP-45

2.03 BALL VALVES

A. Bronze Two-Piece Ball Valves:
   1. Manufacturer and Model:
      a. Threaded Ends:
         1) Apollo 77-100 Series
         2) Equivalent by Crane, Jamesbury or Jenkins
      b. Soldered Ends:
         1) Apollo 77-200 Series
         2) Equivalent by Crane, Jamesbury or Jenkins
   2. 150 psig SWP, non-shock 600 psig WOG, MSS SP-110, cast bronze, full port, two-piece body design, chrome-plated solid bronze ball with reinforced Teflon seats. Stem packing adjustable for wear with adjusting screw.

GENERAL DUTY VALVES FOR HVAC
23 05 23 - 2
2.04 ECCENTRIC PLUG VALVES

A. Balancing Service:
   1. Threaded, class 125
      a. Milliken Millcentric, Figure 613A
      b. Equivalent by Dezurik
   2. Flanged, class 125:
      a. Milliken Millcentric, Figure 611
      b. Equivalent by Dezurik
   3. Ductile iron, permanently lubricated plug-type or multi-turn hand wheel with suitable seals for intended service, lever or multi-turn operator for valves through 6 inches, adjustable memory stops all sizes.

2.05 SWING CHECK VALVES

A. Bronze, 150 psig SWP, 300 psig non-shock WOG, MSS SP-80, class 150, renewable bronze disc.
   1. Manufacturer and Model:
      a. Threaded:
         1) Milwaukee 510-T
         2) Stockham B-321
         3) Equivalent by Crane
      b. Soldered:
         1) Milwaukee 1510-T
         2) Stockham B-321
         3) Equivalent by Crane
   B. Flanged, iron body, 125 psig SWP, 200 psig non-shock WOG, MSS SP-71, Class 125, bronze trim.
      1. Manufacturer and Model:
         a. Milwaukee F2974
         b. Stockham G-931
         c. Equivalent by Crane

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.
3.02 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
   1. Shutoff Service:
      a. Water and Glycol:
         1) NPS 2 and Smaller: Ball valves.
   2. Throttling Service:
      a. NPS 2 and Smaller: bronze: Class 150, threaded.

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. Heating Water Piping: Use the following types of valves:
   1. Ball Valves, NPS 2 and Smaller: Bronze two-piece, threaded or soldered.
   2. Balancing Valves:
      a. NPS 2 and Smaller: Threaded, Class 125.

3.03 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 2315 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. All equipment and materials shall be installed in accordance with the recommendations of the manufacturer.

C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above center of pipe.

F. All valves shall be installed so they are accessible and serviceable. Install valves in position to allow full stem movement.

G. All valves shall be installed so the stem position is not more than 90-degrees from the vertical up position.

H. Isolation valves shall be installed:
   1. In piping at each and every piece of equipment
   2. In piping whenever said pipe enters or leaves an equipment room
   3. At all branch take-offs from mains
   4. Where shown on drawings

I. Valve identification requirements are in other Division 23 sections.

3.04 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer’s written instructions.
3.05 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.

END OF SECTION
SECTION 230700

HVAC – MECHANICAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following insulation for HVAC systems:
   1. Insulation materials
   2. Fire-rated insulation systems
   3. Mastics and adhesives
   4. Jacketing

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.03 DEFINITIONS

A. The word "concealed" as used in this section refers to insulation in ceiling plenums, furred spaces, pipe and duct shafts, unheated spaces immediately below roof and crawl spaces. The word "exposed" refers to insulation in other areas.

1.04 SYSTEM DESCRIPTION

A. Systems to be Insulated: Insulate portions of the following systems, equipment, and accessories, except where noted otherwise or furnished by OEM as part of equipment.
   1. Hot Piping Systems:
      a. HVAC heating water piping
      b. Fittings, valves, strainers, and check valves
   2. Ductwork and Breeching:
      a. Concealed HVAC supply, transfer, and return ductwork except as noted
   3. Items that need not be insulated:
      a. Piping within baseboard (fin tube) radiation enclosures

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.
   8. Detail field application for each equipment type.
C. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting 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 75 or less, and smoke-developed index of 150 or less.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Protect insulation against dirt, water, chemical, or mechanical damage before, during, and after installation. Satisfactorily repair or replace any such insulation or covering damaged prior to final acceptance of the work.

B. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.08 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.09 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 PIPE INSULATION

A. Manufacturers:
   1. Certainteed Crimpwrap
   2. Knauf Insulation; 1000 Pipe Insulation
   3. Rubatex
   4. Owens Corning; Fiberglas Pipe Insulation
   5. Johns Manville; Micro-Lok
B. Preformed fiberglass conforming to ASHRAE 90.1-2004, ASTM C547, Class I or II, and ASTM C585 with "K" factor of 0.23 Btu-in./h-sf-°F maximum at 75°F mean temperature. See schedule for thickness.

C. Provide factory-applied ASJ/SSL type, ASTM C921, or ASTM C1136, Type I jacket with vapor barrier for cold piping (below ambient), or Type II for hot piping (above ambient). Type I may be used for both at Contractor's option. Factory-applied flap adhesive (SSL) or conventional staple and tape seal at Contractor's option.

D. Pipe Insulation Thickness Schedule:

<table>
<thead>
<tr>
<th>Piping System Type</th>
<th>Minimum Insulation Thickness for Pipe Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From:</td>
</tr>
<tr>
<td>To less than:</td>
<td></td>
</tr>
<tr>
<td>NPS 1</td>
<td></td>
</tr>
<tr>
<td>NPS 1-1/2</td>
<td></td>
</tr>
<tr>
<td>NPS 4</td>
<td></td>
</tr>
<tr>
<td>NPS 8</td>
<td></td>
</tr>
<tr>
<td>1. Heating hot water supply and return up to 200°F</td>
<td>1-1/2&quot;</td>
</tr>
</tbody>
</table>

Note: For piping exposed to outdoor ambient temperatures, increase thickness by 0.5 in.

E. Cover fittings and valves with premolded one-piece PVC-insulated covers. This product is not to be installed in locations where its use is prohibited by local codes.

F. Protect insulation on exterior piping exposed to the weather with weatherproof metal jacket. Provide jacket with 0.016-inch-thick aluminum, with laminated vapor barrier. Provide "Z" groove in jacket to assure watertight seal. Seal each joint with snap straps containing permanently plastic sealing compound and secured by 1/2-inch-wide stainless steel bands.

2.02 DUCT INSULATION

A. Specification “A”: 1-1/2-inch-thick fiberglass 3/4 lbs/ft³ density blanket with factory-applied heavy duty FSK facing with a "K" value of 0.28 Btu-in./h-sf-°F maximum at 75°F mean temperature.

B. Specification “B”: 1-1/2-inch-thick, 3.0 lbs/ft³ density fiberglass insulation board. Provide preformed, flat, rectangular, rigid insulation with "K" value of 0.22 Btu-in./h-sf-°F maximum at 75°F mean temperature.

C. Specification “C”: 2-inch-thick, 3.0 lbs/ft³ density fiberglass insulation board equal to CSG Group with factory-applied FSK vapor barrier facing. Provide preformed, flat, rectangular, rigid insulation with a "K" value of 0.22 Btu-in./h-sf-°F maximum at 75°F mean temperature.

D. Specification “L” and “R”: See Duct Liner specification below for materials and required liner thickness.

E. Duct Insulation and Lining Schedule:

<table>
<thead>
<tr>
<th>System</th>
<th>Insulation Spec</th>
<th>Thickness</th>
<th>Vapor Seal Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HVAC supply - concealed</td>
<td>A</td>
<td>1.5”</td>
<td>Yes</td>
</tr>
<tr>
<td>2. HVAC return - concealed</td>
<td>A</td>
<td>1.5”</td>
<td>No</td>
</tr>
<tr>
<td>System</td>
<td>Insulation Spec</td>
<td>Thickness</td>
<td>Vapor Seal Required</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>-----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>3. Medium-pressure supply ducts to CV or VAV terminal units</td>
<td>A</td>
<td>1.5&quot;</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Low-pressure rectangular supply ducts downstream of CV or VAV terminal units.</td>
<td>L</td>
<td>1&quot;</td>
<td>No</td>
</tr>
<tr>
<td>5. Low-pressure round supply ducts downstream of CV or VAV terminal units (just the main round duct downstream of the box when there is no rectangular duct).</td>
<td>R</td>
<td>1&quot;</td>
<td>No</td>
</tr>
<tr>
<td>6. Low-pressure round supply ducts downstream of CV or VAV terminal units (portions without liner).</td>
<td>A</td>
<td>1.5&quot;</td>
<td>No</td>
</tr>
</tbody>
</table>

*UL YYET listing not required on type II duct. Approval from Authority Having Jurisdiction must be obtained prior to application of specification “E” fireproofing wrap.

**Other than kitchen exhausts.

2.03 DUCT LINER

A. General:
1. Comply with requirements of NFPA 90A and 90B, UL 181 Class 1, ASTM C1071, and the Materials Standard of the North American Insulation Manufacturer’s Association (NAIMA); Type 200, Flame Spread 25 maximum and Smoke Development 50 maximum.
2. Absorption: Not more than 1% moisture when tested per ASTM C553.
3. Corrosion: Shall not cause corrosion of duct material (aluminum or galvanized steel) when tested per ASTM C665.
5. Coating: Coat air-stream surface and transverse edge with a factory-coated tough composite material to provide a maximum average velocity rating of 5,000 fpm or better at 250°F when tested per ASTM C1071.
6. Thermal Resistance: "K" value of 0.27 Btu-in./h-ft²-°F for less (1-inch thickness, 1 lb/ft³) when tested per ASTM C518 at 75°F mean temperature.
7. Sound Absorption: Sound absorption coefficient (1-inch thickness, 1 lb/ft³) of 0.72 or higher at 1,000 Hz when tested per ASTM C423, Type A mounting. Round duct liner shall have a Noise Reduction Coefficient (NRC) of 0.70 or better when tested per ASTM C423, Type A mounting.

B. Rectangular Liner, Specification "L": Approved manufacturers are CertainTeed (ToughGard), Knauf type E-M, Owens-Corning (Aeroflex), and Johns-Manville (Permacote Linacoustic).
1. Duct sizes shown on drawings are clear internal dimensions and do not include liner.

C. Round Liner, Specification "R":
1. Approved Manufacturers: Johns-Manville (Spiracoustic Plus).
2. Round Duct Liner:
   a. Use "Spiracoustic Plus" slip-in or snap-in fiberglass duct board with airstream surface Permacote coating or Engineer-approved equal.
   b. Install liner in both straight duct and fittings per manufacturer’s recommendations. Fill and seal all gaps and tears or abrasions per manufacturer’s recommendations. Coat edges exposed to the air-stream with Superseal HV sealant or Engineer-approved equal.
   c. Duct sizes shown on drawings are clear INTERNAL dimensions, increase shell diameter accordingly.
A. Provide materials compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 225.
      d. Mon-Eco Industries, Inc.; 22-25.
   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).

C. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 739, Dow Silicone.
      d. Speedline Corporation; Polyco VP Adhesive.
   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).

2.05 MASTICS

A. Provide materials compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. 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).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 570.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
   3. Service Temperature Range: Minus 50 to plus 220 deg F.
   4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; S50.
   e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 INSTALLERS

A. Install insulation with workmen regularly engaged in this kind of work in strict accordance with the manufacturer's recommendations and recognized industry practices.

3.02 INSTALLATION

A. General:
1. Apply full-length units of insulation on clean, dry surfaces free of foreign matter. Apply only after tests and approvals required by the specifications have been completed.
2. Apply insulation on cold surfaces with a continuous, unbroken vapor seal. Provide insulation and vapor seal at supports, anchors, etc., that are secured directly to cold surfaces to prevent condensation.

3. Finish raw edges with finishing cement.

B. Pipe Insulation:
1. Insulate pipe continuously through walls and floor openings except where walls and floors are required to be fire-stopped or required to have a fire-resistance rating. Where this occurs, fill the open space remaining between the sleeve and pipe with fire-stop.

2. Butt joints firmly together and smoothly, secure self-sealing jacket laps and joint strips with monel staples at 6-inch o.c. and cover with lap adhesive or factory (SSL) adhesive.

3. Seal ends of cold pipe insulation with a vapor barrier coating at fittings and valves and at intervals of 21 feet on continuous runs of pipe.

4. Insulate cold pipes continuously through hangers. Provide rigid insulation inserts at pipe hangers and supports per Division 23 Section "Hangers and Supports for HVAC Mechanical Systems." Abut pipe insulation to the rigid insulation insert. Apply a wet coat of vapor barrier lap cement on butt joints and seal the joints with 3-inch-wide vapor barrier tape or band. Coat staples with heavy coat of brushed on vapor barrier lap cement.

5. Insulate sections of piping where new control valves are to be installed.

C. Insulation on Fittings and Valves:
1. Where the factory premolded one-piece PVC insulated fitting covers are to be used, apply the proper factory precut insulation to the fitting using two layers for pipe temperatures above 250°F or below 35°F, single layer insulation is suitable between 35°F and 250°F. Tuck the ends of the insulation snugly into the throat of the fitting with the edges adjacent to the pipe covering, tufted and tucked in, fully insulating the pipe fitting. Overlap the covers to adjoining pipe insulation and jackets and seal all cold pipes at seam edges with vapor barrier adhesive. Seal the circumferential edges of covers with pressure sensitive tape. Overlap the tape on the jacket and the cover at least 1 inch.

2. At locations where the PVC covers are prohibited, use as an alternate one of the following methods: one-coat insulation cement, premolded fiberglass fitting covers, or mitered segments of pipe insulation. Provide glass fabric embedded in fire-retardant mastic finish. Use vapor barrier mastic for cold piping.

3. Insulate valves with sections of fiberglass pipe insulation complete with all service jackets. Coat raw ends with vinyl acrylic mastic for hot piping or vapor barrier mastic for cold piping.

D. Duct Liner:
1. For velocities up to 2000 fpm, apply duct liner with 100% coverage of fire-retardant adhesive. Cut duct liner to assure snug corner joints. Face the coated or most dense surface of the liner to the airstream. Additionally secure the duct liner with mechanical fasteners that compress the duct liner sufficiently to hold it firmly in place. Start the fasteners within 3 inches of the leading edge of each duct section (and line transverse joints within the duct section) and space no more than 12-inch o.c. around the perimeter of the duct, except that they need to be no closer than 9 inches to a corner break. Elsewhere, secure at a maximum of 18-inch o.c., except place not more than 6 inches from a cut edge, nor 12 inches from a corner break. Coat exposed edges and the leading edge of cross joints of the liner with the same adhesive used to secure the duct liner to the metal surface.

2. Install round duct liner per manufacturer's recommendations:
   a. Install slip-in type (24-inch I.D. or less) in straight duct sections without use of pins or mastic. Insulate fittings with cut sections installed using mastic and/or pins per manufacturer's instructions.
   b. Pin snap-in type (24-inch I.D.) in straight duct sections and pin with mastic in fittings per manufacturer's instructions.
3. Install liner in both straight duct and fittings per manufacturer's recommendations. Fill gaps and tears or abrasions per manufacturer’s recommendations. Coat edges exposed to the airstream with Superseal HV sealant or Engineer-approved equal.

E. Other Requirements:

1. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer’s nameplate. Provide neatly beveled edge at interruptions of insulation.

2. Provide removable insulation sections to cover parts of equipment that must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.

3. Repair damaged sections of existing mechanical insulation, both previously damaged and/or damaged during this construction period. Use insulation of same thickness as existing insulation; install new jacket lapping and seal over existing.

4. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

END OF SECTION
1.01 SUMMARY

A. This section covers the general requirements for the Division 23 responsibilities and performance in the startup, testing, and commissioning process.

1. Mechanical system installation, startup, testing, balancing, commissioning, preparation of O&M manuals, and operator training are the responsibility of the Contractor with coordination, observation, verification the responsibility of Division 1. The Division 1 Commissioning process does not relieve Division 23 from the obligations to complete all portions of the work in a satisfactory and fully operational manner.

2. Work of Division 23 includes:
   a. Testing and startup of the equipment.
   b. Testing, adjusting, and balancing of hydronic and air systems.
   c. Cooperation with the Commissioning Agent.
   d. Providing qualified personnel for performance of start-up, testing, and commissioning tests.
   e. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the start-up, testing, and commissioning process.
   f. Providing operation and maintenance manuals and as-built drawings to the Commissioning Agent for verification.
   g. Providing assistance to the Commissioning Agent to develop and edit system operating and maintenance procedure narratives.
   h. Providing training and demonstrations for the systems specified in this Division.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.03 TRAINING

A. In addition to the requirements of Division 1, coordinate participation in the training of the Owner’s engineering and maintenance staff on each system and related components with the Commissioning Agent. Training will be conducted in a classroom setting, with field demonstrations as appropriate, with system and component documentation and suitable classroom training aids.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Provide test equipment as necessary for testing and startup of the mechanical equipment and systems.

2.02 TEST EQUIPMENT - PROPRIETARY
A. Proprietary test equipment, hardware, and software required by the equipment manufacturer for programming and/or startup, whether specified or not, shall be provided to the Commissioning Agent at no cost. Provide the test equipment, demonstrate its use, and assist the Commissioning Agent in the startup, testing, and commissioning process. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the start-up, testing, and commissioning process.

B. Controls contractor/manufacturer shall provide a printout of:
   1. All software code
   2. All user interface screens

PART 3 - EXECUTION

3.01 WORK PRIOR TO FUNCTIONAL TESTING

A. Complete all phases of work so the systems can be started, tested, balanced, and commissioned. Contractor has primary startup responsibilities for all mechanical systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc.

B. A commissioning plan will be developed by the Commissioning Agency. Division 23 is obligated to assist the Commissioning Agency in preparing the Commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor-initiated system changes have been made that may alter the Commissioning process, the Contractor shall notify the Commissioning Agent and Owner’s representative.

C. Specific pre-commissioning responsibilities of Contractor are as follows:
   1. Factory startup services for the following items of equipment:
      a. Control systems
   2. Normal startup services required to bring each system into a fully operational state. Provide skilled technicians to start up and debug all systems within Division 23. This includes motor rotational check, belt and alignment checks, cleaning, filling, purging, leak testing, testing control sequences of operation, full-load and part-load performance, etc. The Commissioning Agency will not begin the testing and verification process until each system is complete, including normal Contractor startup.

D. Functional testing is normally intended to begin prior to completion of a system and/or subsystems and will be coordinated with the Division 23 Contractor. Start of Commissioning before system completion does not relieve the Contractor from completing those systems as per the schedule.

E. Complete and sign functional performance test forms. Contractor is responsible for assuring the items checked off as complete are ready for Commissioning Agency verification.

3.02 PERFORMANCE OF COMMISSIONING

A. It is the responsibility of the Contractor to perform commissioning testing and demonstration. It is the responsibility of the Commissioning Agent only to coordinate, schedule, observe and verify, and report.

B. The same technicians that performed start-up and testing shall be made available to assist the Commissioning Agency in completing the Commissioning program. Work schedules, time required for testing, etc., will be requested by the Commissioning Agent and coordinated by the Contractor. Contractor will ensure that the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
3.03 WORK TO RESOLVE DEFICIENCIES

A. In some systems misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to start-up, test and commission the systems. This work will be completed under the direction of the Owner’s representative with input from the Commissioning Agency. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Owner will have final jurisdiction over any additional work done to achieve performance.

B. Division 23 corrective work must be completed in a timely fashion to permit the timely completion of the start-up, testing, and commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Owner’s representative, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities.

3.04 ADDITIONAL COMMISSIONING

A. Additional Commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor shall complete this work as part of the Contractor’s basic contractual obligations.

3.05 SEASONAL COMMISSIONING

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. Subsequent commissioning shall be undertaken at appropriate times thereafter to ascertain adequate performance during the different seasons.

B. Cooling equipment shall be tested as close to summer design extremes as possible (subject to Owner schedule limitations) with a fully occupied building. Contractor will be responsible to perform the initial and the alternate peak season tests of the systems as required to demonstrate performance.

C. Training will be hosted by the Commissioning Agent and conducted by the Contractor(s) and vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

END OF SECTION
SECTION 233100

HVAC – DUCTS AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY

A. Section Includes: This section covers general requirements for ducts and accessories including:
   1. Sheet metal materials
   2. Single-wall rectangular ducts and fittings
   3. Single-wall round ducts and fittings
   4. Sealant and gaskets
   5. Hangers and supports
   6. Manual volume dampers
   7. Life safety dampers
   8. Duct mounted access doors
   9. Duct access panel assemblies
   10. Flexible connectors
   11. Flexible ducts
   12. Sound boots

1.03 SUBMITTALS

A. Product Data:
   1. Flexible duct and take-off fittings
   2. Duct sealant and fire-stop materials
   3. Duct access doors
   4. Fire, smoke, and combination fire/smoke dampers:
      a. Submit AMCA-certified pressure drop data.
      b. Document conformance to NFPA 90A and UL555, 555S, or 555C.
   5. Backdraft and relief dampers

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment.
C. Delegated-Design Submittal:
   1. Sheet metal thicknesses.
   2. Joint and seam construction and sealing.
   3. Reinforcement details and spacing.
   4. Materials, fabrication, assembly, and spacing of hangers and supports.
   5. Design Calculations: Calculations for selecting hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire-rated construction.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Perimeter moldings.
   7. Refer to Division 23 Section “Common Work Requirements for HVAC Work” for additional requirements.

E. Welding certificates.

F. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.04 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.

C. Welding Qualifications: Qualify procedures and personnel according to the following:


E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."

1.05 PERFORMANCE REQUIREMENTS

A. Contractor shall furnish and install ductwork and accessories, including offsets and size transitions, which may become evident during the course of construction, to avoid building construction and other considerations, to provide a complete and operational system.
B. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements specified design criteria.

C. Structural Performance: Duct hangers and supports shall withstand the effects of gravity, loads and stresses within limits and under conditions described in the 2006 International Building Code.

D. Air stream Surfaces: Surfaces in contact with the air stream shall comply with requirements in ASHRAE 62.1.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653.
   2. Finishes for Surfaces Exposed to View or Weather: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the duct airway size. Allowance for liner thickness must be added to airway size to determine sheet metal size.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Rectangular Duct Construction" based on indicated static-pressure class unless otherwise indicated.
   1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Button punch lock, detail L-2, is not acceptable.
   3. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. Round Ducts: Fabricate ducts with indicated dimensions for the inner duct airway size. Allowance for liner thickness must be added to airway size to determine sheet metal size.
B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints" for static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. Transverse joints in ducts larger than 60 Inches in diameter shall be flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams" for static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Snap lock seams, RL-6A, RL-6B, RL-7, and RL-8 and lap rivets, RL-3 and RL-4 are not acceptable.
   a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

3. Laterals and Tees Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals" and SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-6, "Conical Tees" for static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.04 DUCT LINER

A. Refer to Division 23 Section "Mechanical Insulation."

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to ASTM E 84 certified by a nationally recognized testing laboratory.

B. Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal, 2-inch.
   2. Manufacturer: Carlisle Hardcast DT-5300-Tape with RTA-50 coating or approved equal.
   5. Mold and mildew resistant.
   6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   7. Service: Indoor and outdoor.
   8. Service Temperature: 0 to 200°F.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
   10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:
   1. Manufacturer: Carlisle Hardcast DS-321 coating or approved equal.
   5. Water resistant.
   6. Mold and mildew resistant.
   7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
11. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flanged Joint Sealant: Comply with ASTM C 920.
1. Description: Extruded butyl/EPDM proprietary copolymer sealant on a siliconized release paper.
2. Manufacturer: Carlisle Hardcast GT-1902, or approved equal.
3. Dimensions: 3/16 inch x 5/8 inch
4. Resistant to mold, mildew and water:
5. Service temperature: Minus 65 to plus 200°F
6. VOC: 0 g/l.
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals: Seal shall provide maximum leakage class of 3 cfm/100 sq ft at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
1. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
2. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.07 MANUAL VOLUME DAMPERS
A. Manufacturers:
   1. Greenheck
   2. Potterff
   3. Ruskin

B. Rectangular, Steel, Low Velocity
   1. Manufacturer: Ruskin MD35, Greenheck MDB-15 or equal
   2. Type: Parallel blade or opposed blade with concealed or exposed linkage, all galvanized steel or all stainless steel
   3. Maximum Velocity: (1,500 fpm) or less
   4. Frame: 16-gauge I, roll formed channel
   5. Blades: 16-gauge
   6. Maximum Blade Width: 8 inches, exception: single blade up to 12 inches.
   7. Blades 36 inches and longer and driven blade shall be furnished with reinforcing cone. Maximum blade length is 48 inches
   8. Shafts: 1/2-inch
   9. Bearings: Synthetic

C. Rectangular, Steel, Medium Velocity
   1. Manufacturer: Ruskin CD60 or equal
   2. Type: Parallel blade or opposed blade with concealed or exposed linkage, all galvanized steel or all stainless steel
   3. Maximum Velocity: (4000 fpm) or less
   4. Frame: 16-gauge I, roll formed channel
   5. Blades: 16-gauge
   6. Maximum Blade Width: 8 inches, exception: single blade up to 12 inches
   7. Blades 36 inches and longer and driven blade shall be furnished with reinforcing cone. Maximum blade length is 48 inches
   8. Shafts: 1/2-inch
   9. Bearings: Synthetic

D. Round, Steel
   1. Manufacturer: Ruskin MDRS23, Greenheck MDB-15 or equal.
   2. Type: Single blade up to 20-inch diameter; use rectangular steel with round adapter above 20-inch diameter.
   3. Maximum Velocity: (2,000 fpm) or less.
   4. Frame: 20-gauge galvanized steel or stainless steel.
   5. Blades: 20-gauge galvanized steel or stainless steel.

E. Damper Actuators: Provide locking quadrant operators on all dampers unless otherwise noted on plans

2.08 LIFE SAFETY DAMPERS

A. Approved Manufacturers (Note: Not all manufacturers listed have products listed in all categories specified.):
   1. Greenheck
   2. Potterff
   3. Ruskin

B. Fire Dampers:
   1. Type: Dynamic; rated and labeled according to UL 555 by a nationally recognized testing laboratory.
2. Rating: 1-1/2 hours, unless noted otherwise on plans.
3. Curtain Type Dampers
   a. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
   b. Frame: Fabricated with roll-formed, 20 gauge-thick galvanized steel; with mitered and interlocking corners. Blade out of airstream except in wall openings with register or grille.
   c. Blades: 20 gauge-thick, galvanized sheet steel curtain type.
   d. Horizontal Dampers: Include blade lock where required and stainless-steel closure spring.
   e. Ruskin DIBD20 or equal.
4. Round, Single Blade Dampers
   a. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
   b. Frame: 20 gauge-thick galvanized steel; integral sleeve with retaining plates.
   d. Ruskin FDR25 or equal.
5. Multi-Blade Airfoil
   a. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm (20-m/s) velocity.
   b. Frame: Fabricated with roll-formed, 16 gauge-thick galvanized steel; with mitered and interlocking corners.
   c. Blades: 14-gauge-thick, galvanized sheet steel airfoil blade.
   d. Ruskin FD60 or equal.
6. Mounting Orientation: Vertical or horizontal as indicated.
7. Mounting Sleeve/Transition Collars: Factory- or field-installed, galvanized sheet steel.
   a. Minimum Thickness: 0.052-inches thick, as indicated, and of length to suit application.
      Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
   b. Sealed for duct pressure class 3-inch wg and lower, welded for greater pressure classes.
   c. Provide transition sleeves for curtain dampers 16-inches in height/diameter or smaller to provide 100% free area.
E. Combination Fire and Smoke Dampers:
1. Type: Dynamic; rated and labeled according to UL 555 and UL 555 S by a nationally recognized testing laboratory.
2. Rating: 1-1/2 hours, unless noted otherwise on plans.
3. Leakage: Class I
4. Multi-blade airfoil with closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
5. Frame: Fabricated with roll-formed, 16 gauge thick galvanized steel; with mitered and interlocking corners.
7. Ruskin FSD60 or equal.
8. Mounting Orientation: Vertical or horizontal as indicated.
   a. Minimum Thickness: 0.052-inches thick, as indicated, and of length to suit application.
      Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
   b. Sealed for duct pressure class 3-inch wg and lower, welded for greater pressure classes.
10. Damper Actuators:
    a. Non-stall type actuators qualified under UL 555S to an elevated temperature of 350°F.
    b. Damper and actuator shall be supplied as a single entity and shall be installed by the damper manufacturer at time of damper fabrication.
    c. Damper actuator shall be 120v/1 ph/60 Hz, modulating, fail close
11. High-temperature Release Devices: Each fire/smoke damper shall be furnished with a heat/fire release (trip) device as follows:
   a. Dampers shall have electric manual reset type temperature actuator 165°F, Ruskin EFL 200 or approved equal.

12. Damper Position Indication: Each damper shall be equipped with an indication device that shall include (two) position indicator switches linked directly to the damper to remotely indicate damper full-open and full-closed blade positions.

2.09 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Cesco Products; a division of Mestek, Inc.
   3. Ductmate Industries, Inc.
   5. Greenheck Fan Corporation
   6. McGill AirFlow LLC
   7. Nailor Industries Inc.
   8. Pottorff; a division of PCI Industries, Inc.
   9. Ventfabrics, Inc.

   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1" x 1" butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.

   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
      a. Number of Hinges and Locks:
      b. Access Doors Less Than 12 inches Square: No hinges and two sash locks.
      c. Access Doors up to 18 inches Square: Two hinges and two sash locks.
      d. Access Doors up to 24" x 48": Three hinges and two compression latches.
      e. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

<table>
<thead>
<tr>
<th>Size of Duct to be Accessed</th>
<th>Panel Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 8-inch</td>
<td>4 x 8-inch</td>
</tr>
<tr>
<td>10 – 12-inch</td>
<td>8 x 12-inch</td>
</tr>
<tr>
<td>12 – 16-inch</td>
<td>10 x 16-inch</td>
</tr>
<tr>
<td>18-inch and over</td>
<td>16 x 24-inch</td>
</tr>
</tbody>
</table>

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers
   1. Ductmate Industries, Inc.
   2. Flame Gard, Inc.
   3. 3M.
B. Labeled according to UL 1978 by an nationally recognized testing laboratory.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

2.12 FLEXIBLE DUCTS

A. Manufacturers:
   1. Flexmaster U.S.A., Inc.
   2. Thermaflex
   3. Hercules.

B. Non-insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 20 to plus 210 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 10 to plus 160 deg F.

D. Flexible Duct Connectors: Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.
2.13 SOUND BOOTS

A. Plenum ceiling return grille sound boots shall be fabricated from sheet metal with 1-inch liner. Sound boots shall be a 90-degree elbow with the vertical leg sized to the grille and the horizontal leg cross-section 50% of the grille face area and extending horizontally from the vertical leg the length of the grille long dimension.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Duct Installation:
1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install ductwork systems including field identified offsets and adjustments required to avoid conflict with building construction and other conditions. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings, Coordination Drawings, or Requests for Information.
2. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
4. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
5. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
6. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
7. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
8. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
9. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
10. Where ducts pass through fire-rated interior partitions and exterior walls in unsprinkled buildings, install fire dampers.
11. All ductwork shall be fabricated and installed so that no undue vibration or noise results. Joints per seal class shall be sealed airtight with additional taping and caulking provided if necessary.
12. Provide all necessary manual, backdraft, and relief dampers as required for proper adjustment and control of air distribution.
   a. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   b. Install steel volume dampers in steel ducts.
   c. Install aluminum volume dampers in aluminum ducts.
   d. Set dampers to fully open position before testing, adjusting, and balancing.
13. At all places where inside of duct will be visible through grilles, louvers, etc., paint visible inside portion of duct flat black.
14. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

DUCTS AND ACCESSORIES
23 31 00 - 10
a. On both sides of duct coils.

b. Upstream from duct filters.

c. At outdoor-air intakes and mixed-air plenums.

d. At drain pans and seals.

e. Downstream from manual volume dampers, backdraft dampers, and equipment.

f. Upstream or downstream of control dampers.

g. Upstream or downstream security bars.

h. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers. Paint access doors red.

i. At each change in direction and at maximum 50-foot (15-m) spacing.

j. Upstream [and downstream] from turning vanes.

k. Upstream or downstream from duct silencers.

l. Control devices requiring inspection.

m. Elsewhere as indicated.

15. Install access doors to swing against static

16. Install flexible connectors to connect ducts to equipment.

17. Transitions in ductwork, in changing shapes and sizes, shall be made with angles not exceeding 15 degrees (diverging) or 30 degrees (converging) wherever possible.

18. Flexible duct shall be used on supply diffuser run outs only, and only where indicated. Flexible ducts shall be installed using lengths not exceeding 8 feet (low-pressure) to make the connection. Duct shall be suspended at intervals not exceeding 5 feet with a minimum 1-inch-wide, 22-gauge steel band. Maximum allowable sag is 1/2 inch per foot of spacing between supports.

19. Flexible duct shall be installed such that obstructions do not crush, distort or otherwise intrude on the flexible duct.

20. Contractor shall not provide holes in the duct systems for the installation of hangers for other equipment. Work of all other trades shall be so coordinated as to render this unnecessary.

21. At ends of ducts that are not connected to equipment, ductwork, or air distribution devices at time of ductwork installation, provide a temporary closure of plywood or corrugated cardboard backed polyethylene film or other covering that will prevent entrance of moisture, dust, and debris and duct leakage until time connections are to be completed.

B. Installation of Exposed Ductwork

1. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

2. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

3. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

4. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

5. Repair or replace damaged sections and finished work that does not comply with these requirements.

C. Additional Installation Requirements for Commercial Kitchen Hood Exhaust Duct

1. Kitchen exhaust ducts shall be welded throughout and installed in accordance with NFPA 96 (Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment) and the International Mechanical Code. Exposed ductwork from hood to the ceiling shall be 18-gauge type 316 stainless steel with welded joints and connections.

2. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
3. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet, in horizontal ducts, at both sides of each change in direction 45° or greater, and at every floor for vertical ducts, and as further indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

4. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

D. Duct Penetrations through Wall and Floors:
   1. Provide 1-inch angle collars for all exposed ducts passing through walls, ceilings, or floors. Anchor collars in position after installation is complete.
   2. Where vertical ducts pass through floors, supporting angles shall be rigidly attached to ducts and to the floor. Angles shall be galvanized and of approved sizes to properly support the ductwork. The supporting angles shall be placed on at least two sides of the duct.
   3. Where horizontal ducts pass through walls and vertical ducts pass through floors, opening shall be tightly sealed off so as to provide a tight seal between duct and opening. Refer to Division 7 for approved fire stop materials to be used at all rated walls and floors.

3.02 DUCT PROTECTION
   1. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction."
   2. Store duct sections on jobsite in clean, dry area. Duct ends and openings shall be covered and protected from dirt and moisture.
   3. Cover and protect duct openings from dirt and moisture during and after erection.
   4. Cover return ducts openings with MERV 8 filters whenever air handlers are operated during construction.
   5. Provide weekly, dated photographs of protected stored material, protected installed material, and installed filters. Provide provide photographs on a more frequent basis as required by other requirements of the project.
   6. Submit statement and photographs documenting duct protection.

3.03 SEALING OF DUCTS
   A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
      1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
      2. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-inch wg and Lower: Seal Class C.
      3. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-inch wg: Seal Class B.
      4. Conditioned Space, Exhaust Ducts: Seal Class B.
      5. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION
   A. Install hangers and supports for metal ducts and fittings to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

   B. Attachments and Spacing
      1. Building Attachments: Verify attachment methods with structural drawings. Use concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
      2. Where practical, install concrete inserts before placing concrete.
      3. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
      4. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100-mm) thick.
5. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100-mm) thick.
6. Do not use powder-actuated concrete fasteners for seismic restraints.
7. Hanger Spacing: Comply with SMACNA for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection unless more restrictive by SMACNA.
8. Hangers Exposed to View: Threaded rod and angle or channel supports.
9. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
10. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 LIFE SAFETY DAMPERS

A. Install all fire, smoke, and combination fire/smoke dampers in strict accordance with UL listing, NFPA 90A, 90B, 92A, IMC, and manufacturer’s requirements. Sleeves and methods of support shall be as detailed in manufacturer’s UL instructions, in NFPA documents, or per local codes if more stringent. Apply firestopping material only if specified in manufacturer’s installation instructions.

B. Provide access doors (labeled per the applicable codes and painted red) located to provide access to all fire, smoke, and combination fire/smoke dampers, except fire dampers located behind removable grilles and diffusers will not require duct access doors unless access through removable device is not practical.

3.06 DAMPERS

A. Install control dampers furnished by Division 23 Section "HVAC-Instrumentation and Controls for HVAC," at locations shown on drawings.

B. Install backdraft and control dampers on exhaust fans as near the building envelope exit as possible, unless otherwise indicated on drawings.

3.07 CONNECTIONS

A. Provide flexible and fabric connections at inlet and discharge duct connections to in-line fans, fan coil units and air handling equipment, except when fans are internally isolated. Flexible connections shall be securely fastened to the duct and equipment per SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible." Allow at least 1 inch of slack.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.08 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

B. Paint access doors to life safety dampers red.

C. Paint materials and application requirements are specified in Division 09 painting Sections.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Inspect turning vanes for proper and secure installation.

C. Leakage Tests
   2. Test the following systems:
      a. Contractor shall, at the beginning of the work, construct, erect, and leak test a representative sample of the duct construction to be used at the +3-inch w.g. pressure class. The sample specimen shall include at least five transverse joints, typical seams, an access door, and at least two typical branch connections plus an elbow. Tests and necessary repair shall be completed prior to concealment of any ducts.
   3. Test for leaks before applying external insulation.
   4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   5. The leakage amount shall not exceed the allotted amount for the pressure class or the allotted amount for that portion of the system, whichever is applicable.

<table>
<thead>
<tr>
<th>Duct Construction Class</th>
<th>Leakage Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>4-inch to 10-inch w.g.</td>
<td>6</td>
</tr>
<tr>
<td>3-inch w.g.</td>
<td>12</td>
</tr>
<tr>
<td>2-inch w.g.</td>
<td>24</td>
</tr>
</tbody>
</table>

*Note: Refer to Part 1 for leakage criteria.*

6. Leakage test procedures shall follow the outlines and classifications in the SMACNA HVAC Duct Leakage Test manual.

7. Give seven days' advance notice for testing.

D. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

E. Duct system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with this section for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer’s written instructions after removal of surface deposits and debris.

F. Duct Systems: Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Supply Ducts:
1. Ducts Connected to Terminal Units:
   a. Pressure Class: Positive 1-inch w.g.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round: 12.
2. Ducts Connected to Variable-Air-Volume Air-Handling Units:
   a. Pressure Class: Positive 3-inch w.g.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round: 3.

C. Return Ducts:
   1. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 2-inch w.g.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round: 6.

D. Intermediate Reinforcement:
   2. PVC-Coated Ducts: Match duct material
   3. Stainless-Steel Ducts: Match duct material

E. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Radius Type RE 1 with minimum 1.5 radius-to-width ratio.
      b. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," with 1-1/2-inch spaced and 2-inch radius, small single width vanes and Figure 2-4, "Vane Support in Elbows."
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      a. Minimum radius-to-diameter ratio shall be 1.5 and elbow segments shall be 5: Elbows with less than 90-degree change of direction have proportionately fewer segments.
      b. Radius-to Diameter Ratio: 1.5.
      c. Round Elbows, 12 inches and Smaller in Diameter: Stamped or pleated.
      d. Round Elbows, 14 inches and Larger in Diameter: Standing seam or Welded.

F. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connections."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Conical spin-in.
      c. Branch to Run Out: Conical spin-in with damper.
   2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity to 1500 fpm: Conical tap.
      b. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION
SECTION 233600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY
A. Section Includes: This section covers the general requirements for air terminal units including:
   1. Variable air units

1.03 SUBMITTALS
A. Product Data: Submit manufacturer's technical and performance data for all air terminal units:
   1. Submittal data for each air terminal unit shall include:
      a. Primary air inlet size
      b. Primary air design cfm as scheduled
      c. Primary air maximum airflow without exceeding specified sound levels
      d. Primary air minimum cfm as scheduled
      e. Primary air minimum controllable airflow
   2. Submittal data for each fan-powered unit shall also include:
      a. Type of fan speed control
      b. Unit discharge airflow with fan or high speed
      c. Minimum airflow delivered at lowest fan speed setting
B. Wiring Diagrams: Submit wiring and control diagrams for air terminal units.

1.04 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Approved Manufacturers: ETI, Nailor, Price, and Titus.

2.02 VARIABLE AIR VOLUME
A. Casing: 0.034-inch steel sheet metal.
   1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
   2. Lining: 1-inch-thick, coated, fibrous-glass or cotton duct liner complying with ASTM C 1071; secured with adhesive.
B. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.

C. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

D. All terminal units shall be pressure independent type. Terminal unit capacities and configuration shall be as scheduled on the drawings. Units shall have factory catalog performance ratings that match or exceed those indicated on the drawing schedules.

E. Terminal units shall have flow taps with calibration chart on unit for airflow measuring and balancing.

F. Provide quick-opening gasketed-type access door(s) as required to permit access to all internally mounted devices which may require adjustment, lubrication, and/or replacement, such as volume controllers, damper actuators, fans and motors, etc.

G. Air terminals shall be selected so required dB sound levels are not exceeded at 1.5-inch w.g. inlet pressure. Both unit casing radiated sound levels and discharge sound levels shall be considered in terminal unit selection.

H. Variable Air Volume Terminal Units:
   1. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.
   2. Maximum wide-open static pressure requirement for box shall be 0.35-inch w.g.
   3. Maximum flow (and minimum flow rates on VAV units) shall be field-adjustable.
   4. Shall have cross type averaging flow element in primary air inlet for air volume control.
   5. Provide access doors upstream and downstream of all reheat coils.

2.03 TEMPERATURE CONTROLS

A. The building DDC system Contractor to furnish DDC controls including all actuators and controllers. When requested by the DDC system contractor, terminal unit controls shall be factory mounted and wired at his expense.

B. Refer to the Section 23 09 93 for Sequence of Operation descriptions.

2.04 SOURCE QUALITY CONTROL

A. Terminal units shall be tested and rated in accordance with ARI 880 "Industry Standard for Air Terminals" and shall bear the ARI certification seal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Support terminal units from structure using threaded rod and brackets. Install terminal unit to allow complete access to controls. Mount fan powered boxes with Specification “D” isolators in Division 23 Section “Common Work Results for HVAC.”
B. Inlet branch duct(s) shall be rigid medium-pressure duct with a minimum of 3 feet of straight duct ahead of unit inlet(s).
   1. Arrange medium-pressure ducts and takeoffs so there are no more than two elbows or bends up to 90-degrees in branch duct to inlet(s); "U" bends will not be allowed.

C. Water Coil Piping Connections: Provide shut-off valves, P & Ts, flow measurement and balancing valve, drain and air vent, and as further detailed on drawings.

D. Provide a minimum of 5 feet of lined low-pressure ductwork prior to first spin-in fitting or supply air outlet branch duct takeoff.

E. Coordinate terminal unit installation with the building DDC system contractor.

END OF SECTION
SECTION 233700
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY

A. Section Includes: This section covers the general requirements for grilles, registers, and diffusers, louvers and intake and relief hoods.

1.03 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.04 SUBMITTALS

A. Product Data:
   1. For each model indicated, include the following:
      a. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
      b. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
      c. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
      d. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
   2. Provide sufficient submittal data for air distribution devices to verify that required space sound levels will not be exceeded.

1.05 SYSTEM DESCRIPTION

A. Performance Criteria: All equipment and material furnished under this section shall be selected so required RC sound levels in various spaces are not exceeded. Attenuation by ceilings, duct liner, and room absorption may be taken into account when making fan, terminal unit, and air distribution selections. Refer to the latest edition of the ASHRAE Applications Handbook for further information.
2.01 GRILLES, REGISTERS, AND DIFFUSERS

A. Approved Manufacturers: Metalaire, Nailor, Price, and Titus.

B. Air outlets and inlets shall be performance tested and rated in accordance with ADC Test Code 1062 and ASHRAE Standard 70.

C. Provide grilles, registers, diffusers, slots, and accessories of size and type as indicated and/or scheduled on the drawings. Select devices so required space RC sound levels are not exceeded.

D. All grilles, registers, and diffusers shall have white baked-on enamel finish.

E. Provide ceiling grilles, registers, and diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. (Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling diffuser.)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Grilles, Registers, and Diffusers:
   1. Grilles, registers, and diffusers shall be installed level and plumb and supported per manufacturer’s recommendations and per the International Building Code.
      a. Ceiling-mounted air devices (supply diffusers and/or return and exhaust grilles and registers) or services weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
      b. Devices or services weighing 20 pounds, but not more than 56 pounds, in addition to the above, shall have two 12-gauge hangers connected from the device or service to the ceiling system hangers or to the structure above. These wires may be slack.
      c. Air devices or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.
   2. Ductwork visible behind grilles, registers, and diffusers shall be painted flat black.
   3. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
   4. Refer to architectural reflected ceiling plan for locations of grilles, registers and diffusers.

3.03 ADJUSTING

A. Grilles, Registers, and Diffusers: Throw patterns (directions) shall be furnished and/or adjusted to match those shown and/or scheduled on the drawings.

END OF SECTION
SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 DEFINITIONS

A. Refer to Article l00 of the currently adopted National Electrical Code for definitions as applicable to this project.

B. Other definitions:
   1. "Concealed": Embedded in masonry, concrete or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
   2. "Exposed": Not installed underground or "concealed" as defined above.
   3. "Furnish" or "Provide": To supply, install and connect up complete and ready for safe and regular operation of particular work unless specifically otherwise noted.
   4. "Install": To erect, mount and connect complete with related accessories.
   5. "Indicated", "Shown" or "Noted": As indicated, shown or noted on drawings or specifications.
   6. "Related Work" includes, but is not necessarily limited to, mentioned work associated with, or affected by, the work specified.
   7. "Reviewed", "Satisfactory", "Accepted", or "Directed": As reviewed, satisfactory, accepted, or directed by or to Engineer.
   9. "Supply": To purchase, procure, acquire and deliver complete with related accessories.
   10. "Wiring": Raceway, fittings, wire, boxes and related items.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with General Conditions of Contract and the requirements of Section 0l 33 00.

B. Shop drawings shall include equipment catalog cuts or manufacturer's printed data identifying: dimensions, weights, recess openings, equipment arrangements, electrical characteristics with bus size, electrical rating, material, wiring diagrams indicating circuit arrangement and NEMA rating for, but not limited to the following:
   1. Network Lighting Controls
   2. Contactors
   3. Wiring Devices
   4. Interior and Exterior Lighting
   5. Hangers and Supports for Electrical Systems
   6. Grounding and Bonding
   7. Multi-Outlet Assemblies
   8. Electrical Systems Control
C. Submit composite coordination drawings to include location and routing of the electrical system components in relation to the mechanical ducts, piping and structural beams.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: All electrical work at the University shall be performed by a State of Colorado licensed contractor under the supervision of a licensed electrician. Contractors shall verify that electricians are currently licensed by the State of Colorado and shall supply Project Manager with names and license numbers. Contractor shall have a minimum of 3 years of satisfactory performance in conducting the type of work specified.

3. NECA - Standard of Installation.
5. IEEE – The Institute of Electrical and Electronics Engineers.
7. The University/Anschutz Medical Campus Project Guidelines and Standards.
8. International Building Code in accordance with the Campus Building Official.
9. ASTM - American Society of Testing Materials
10. IPCEA - Insulated Power Cable Engineers Association
11. Underwriter's Laboratories (UL)
12. American National Standards Institute (ANSI)
13. Other requirements as listed elsewhere in these specifications.

B. The drawings and specifications take precedence when they are more stringent than codes, statutes, or ordinances in effect. Applicable codes, ordinances, standards and statutes take precedence when they are more stringent than, or conflict with the drawings and specifications.

C. Record Documents:

1. Maintain a separate set of contract electrical drawings at the site in accordance with Section 01 74 00 to show the following:
   a. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
   b. All branch circuits, feeders, communications conduits embedded in concrete, dimensioned from prominent building lines.
   c. Equipment locations (exposed and concealed) dimensioned from prominent building lines.
   d. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

D. Operations and Maintenance Data:

1. O and M Data shall be provided in accordance with Section 01 78 23 including the following information:
   a. Description of function, normal operating characteristics and limitations, fuse curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
b. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

c. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

d. Servicing instructions and lubrication charts and schedules.

e. Complete list of parts and wiring diagrams.

f. Names, addresses and telephone numbers of the Contractor, Subcontractors and local company responsible for maintenance of each system or piece of equipment.

g. All information shall be permanently bound in a 3-ring binder. The job name and address, and Contractor's name and address shall be placed on the cover and spine of each binder in a permanent manner. Dymo-tape is not acceptable.

h. Copies of all test reports shall be included in the manuals.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with manufacturer's instructions, and the requirements of Section 01 10 00.

1.05 WARRANTY

B. All electrical equipment, materials and workmanship warranties shall be provided in accordance with the requirements of Section 01 78 36 and the following:

i. The Contractor warranties the electrical system, material and workmanship, for a period of one year from the date of the University final acceptance of the installation unless as otherwise noted in Commissioning.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. All equipment and materials installed shall be new, unless otherwise specified. Defective or damaged materials shall be replaced or repaired, prior to final acceptance, in a manner acceptable to the Engineer or The university and at no additional cost to the University.

B. All electrical materials shall be acceptable for installation only if labeled or listed UL and, if accepted, by the authority having jurisdiction.

C. All major equipment components shall have the manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

D. Fire Seals:
1. **Material:** Fire stopping material shall be asbestos free, 100% intumescent, have code approval under BOCA, ICBO, SSBC, NFPA 101, NFPA 70, and be capable of maintaining an effective barrier against flame and gases in compliance with the following requirements.

2. **Flame Spread:** 25 or less, ASTM E84

3. **Fire Resistance and Hose Stream Tests:** Fire stopping materials shall be rated "F" and "T" in accordance with ASTM E 814 or UL 1479. Rating periods shall conform to the following:

<table>
<thead>
<tr>
<th>(F)</th>
<th>(T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Time-rated floor or wall assemblies.**

<table>
<thead>
<tr>
<th>(F)</th>
<th>(T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Openings between floor slabs & curtain wall.**

---

**PART 3 - EXECUTION**

3.01 **INSTALLATION, GENERAL**

A. Construct Work in sequence under provisions of Division I where applicable.

B. Electrical Contractor shall coordinate Divisions 26, 27, and 28 work with the installer of Division 21, 22 and 23 and other work to ensure that code required clearances relating to space required for access to electrical equipment is properly maintained.

C. Install Work using procedures defined in NECA Standard of Installation.

D. Workmanship shall conform to highest industry standards for each trade involved in installation of the Work.

E. Upon completion of work, all equipment and materials shall be installed complete, thoroughly checked, correctly adjusted, and left ready for intended use or operation. All work shall be thoroughly cleaned and all residues shall be removed from surfaces.

F. Exterior surfaces of all material and equipment shall be delivered in a perfect, unblemished condition.

G. Carefully lay out all work in advance so as to eliminate where possible, cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings and roofs. Any damage to the building, structure, piping, ducts, equipment or any defaced finish shall be repaired by skilled mechanics of the trades involved at no additional cost to the University.

H. All openings made in fire-rated walls, floors, or ceilings shall be patched and made tight in a manner to conform to the fire rating for the surface penetrated. Paint to match surface when visible.

I. All penetrations required through completed concrete construction shall be core drilled at minimum size required. Precautions shall be taken when drilling to prevent damage to structural concrete. The Contractor shall obtain permission from the Architect and Structural engineer before proceeding with drilling.

J. **Sleeve Seals:** Provide sleeve seals for penetrations located in foundation walls below grade, or in exterior walls, of one of the following:
1. Caulk between sleeve and raceway with approved Caulk material.
2. Mechanical Sleeve Seals: Modular mechanical type, as manufactured by Thunder line Corp., consisting of interlocking synthetic rubber links shaped to continuously fill annular space between raceway and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal.

K. Install equipment and materials to provide required Code clearances and access for servicing and maintenance. Coordinate the final location with piping, ducts, and equipment of other trades to insure proper access for all trades. Coordinate locations of concealed equipment, disconnects, and boxes with access panels and doors. Allow ample space for removal of parts, fuses, lamps, etc., that require replacement or servicing according to the National Electric code and the AHJ.

L. Extend all conduits so that junction and pull boxes are in accessible locations.

M. Install access panel or doors where equipment or boxes are concealed behind finished surfaces in areas such as restrooms. These access doors shall be a minimum of twenty by twenty inches or as required to accommodate full pull box or equipment access.

N. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

O. Electrical system layouts indicated on drawings are generally diagrammatic but shall be followed as closely as actual construction and work of other trades will permit. Govern exact routing of raceways and locations of outlets by structure and equipment served. Take all dimensions from engineering drawings.

P. Consult all other drawings. Verify all scales and report any dimensional discrepancies or other conflicts to Engineer before submitting bid.

Q. All home runs to panel boards are indicated as starting from outlet nearest panel and continuing in general direction of that panel. Continue such circuits to panel as though routes were completely indicated.

R. Furnish and install all necessary hardware, hangers, blocking, brackets, bracing, runners, etc. required for equipment specified under this Division.

S. Remove all unused or abandoned conduit, junction boxes, panels, and other electrical components back to the source.

T. Provide GFCI type receptacles for all "above counter" receptacles located within 6' of any sink or basin.

U. Clean all luminaries, lamps and lenses prior to final acceptance. Replace all inoperative lamps.
V. Provide all power feeds and final connections to motors and other electric equipment furnished under Divisions 21, 22, and 23.
   1. Install and wire through all control devices which directly handle full load motor or electric heating equipment current, such as magnetic starters, line voltage thermostats, P.E. switches, etc. which are furnished by Electrical Contractor. Located where shown on the electrical drawings.
   2. Provide disconnects for all mechanical equipment as indicated on project drawings.
   3. Provide all power and control wiring which directly handles full load current of motors or electric heating equipment.

3.02 TESTING, CLEANING AND CERTIFICATION

A. Operating and Acceptance Tests: Provide all labor, instruments, and equipment for the performance of tests as specified below and elsewhere in these specifications.
   1. Perform a careful inspection of the main switchboard bus structure and cable connections to verify that all connections are mechanically and electrically tight.
   2. For a one-day period after the remodeled area has been placed into normal service, record the full load current in each phase or each line at the panel bus and submit to the Engineer.

B. Test Reports:
   1. Test Reports: Submit three (3) copies of test results.
   2. The final University inspection of the project will not be made until a satisfactory report is received and approved by the University Project Manager.
   3. Results shall include:
      a. Insulation resistance readings for all motors and motor feeders 5 horsepower or greater.

C. Clean-Up: Remove all materials, scrap, etc., relative to the electrical installation, and leave the premises and all equipment, lamps, fixtures, etc. in a clean, orderly condition. Any costs to the University for clean up of the site will be charged against the Contractor.

3.03 COMMISSIONING (DEMONSTRATION)

A. Acceptance Demonstration: Upon completion of the work, at a time to be designated, the Contractor shall demonstrate for the University the operation of the entire installation, including all systems provided under this contract.

B. The Contractor shall furnish the services of a qualified representative of the supplier of each item or system who shall instruct specific personnel, as designated by the University, in the operation and maintenance of that item or system.
   1. Instruction shall be given when the particular system is complete, and shall be of the number of hours indicated. A representative of the Contractor shall be present for all demonstrations.

END OF SECTION
SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART I - GENERAL

1.01 SUBMITTALS

A. Product data shall be submitted for in accordance with the requirements of Section 26 05 00 each of the following:
   1. Wires
   2. Cables
   3. Connectors

1.02 QUALITY ASSURANCE

A. Wire and cable shall be provided and installed in accordance with the requirements of Section 26 05 00.

B. Installer Qualifications and Certifications: Firms with at least 3 years of successful installation experience with projects utilizing electrical wiring cabling work similar to that required for this project.

C. Regulatory Requirements: Conform to applicable code relations regarding toxicity of combustion products of insulating materials.

D. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Wire and cable shall be delivered, stored and handled in accordance with the requirements of Section 26 05 00.

B. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.

C. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

D. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

1.04 WARRANTY

A. Wire and cable warranties shall be provided in accordance with the requirements of section 26 05 00.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of wire, cable, and connector):

1. Wire and cable:
   a. Triangle - PWC
   b. American Wire and Cable Co.
   c. Anaconda-Ericsson Inc; Wire and Cable Div.
   d. Belden Div; Cooper Industries
   e. General Cable Corporation
   f. General Electric
   g. Okonite

2. Connectors:
   a. O-Z/Gedney Co.
   b. AMP, Inc.
   c. Burndy Corporation
   d. Ideal Industries, Inc.
   e. 3M Company
   f. Thomas and Betts Corp.

2.02 MATERIALS, GENERAL

A. Wires and Cables:

1. Provide new wire and cable suitable for the temperature, conditions, and location where installed. All cable shall be new and shall conform to or exceed IPCEA requirements. Building wire shall be insulated with THHN/THWN/THW or XHHW insulation, rated 600 volt.

2. Conductors: Provide solid conductors for power and lighting circuits I2 AWG and smaller. Provide stranded conductors for I0 AWG THHN/THWN and larger. In sizes 250 MCM and larger use type THW or THWN. In sizes #I AWG and smaller all conductors shall have heat/moisture resistant thermoplastic insulation type THW or THWN (75 degree C), except as follows:
   a. Where conduit temperature will exceed 100 degree F, use type THHN (90 degree C). Type XHHW (90 degree C) permissible in dry locations.
   b. In 120-volt incandescent fixtures, type AF (150 degree C).
   c. In wire ways of fluorescent lighting fixtures types THW-MTW, THHN (90 degree C).

3. Conductor Material: Provide copper for all wires and cables.

4. Metal Clad cable is acceptable.

5. Use colors of wires as specified in paragraph 3.5 of this section.

6. For general applications, other than special use, use THHN insulated wire.

7. Type NM, NMC, NMS cable are not acceptable for any application.

8. Use copper wire only.

9. No wire splices shall be allowed in the conduit or conduit fittings. All splices shall be done in an approved box.
I0. Grounding conductors shall be copper type THHN with green integrally-colored insulation, sized to meet NEC.

II. Plenum rated cable when required by Plenum conditions.

B. Connectors:
   1. Provide UL type factory-fabricated, solder less metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperatures equal to or greater than those of the wires upon which used.

C. Wiring to Light Fixtures:
   1. Type THHN to fluorescent light fixtures, 12-gauge minimum.
   2. Type THHN to incandescent fixtures, 12-gauge minimum.

D. Wire Connectors:
   1. For wires size #8 AWG and smaller, insulated pressure type (with live spring) rated 105 degree C, 600 volt, for building wiring and 1000 volt in signs or fixtures. 3M or Ideal.
   2. For wires size #6 AWG and larger, T & B or equivalent compression type with 3M #33 or #88 tape insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

   A. Verify that mechanical work likely to damage cable has been completed.

3.02 INSTALLATION, GENERAL

   A. Install electrical cables, wires and connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA’s “Standard of Installation”, and in accordance with recognized industry practices.

   B. Coordinate wire/cable installation work, including electrical raceway and equipment connection work, with other work. Pull no wire into any portion of conduit system until all construction work, which might damage the wire, has been completed.

   C. BAS Conductor installation: (see Section 23 09 l3)

   D. Wires and Cables:
      1. On systems greater than 600V thoroughly swab raceway before installing wire. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant on all cable installations. compound used shall not deteriorate conductor or insulation.
      2. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed manufacturer's tension requirements.
3. Keep conductor splices to minimum. Install all wire continuous from outlet to outlet or terminal to terminal. Splices in cables when required shall be made in hand holes, pull boxes, or junction boxes and shall be in strict accordance with cable manufacturer’s recommendations utilizing solder less connectors NEMA/UL approved for the use. Splice only in accessible junction boxes. Use splices and tap connectors which are compatible with conductor material.

4. Install splices and tapes, which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

5. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer’s published torque tightening values. Where manufacturer’s torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486 for copper.

6. Support cables above accessible ceilings, do not rest on ceiling tiles. Use spring clips and hanger rods, bridle rings or ‘J’ hooks, independent from the ceiling suspension system to support cables from structure.

7. Provide adequate length of conductors within electrical enclosures and form the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than 10 AWG cables to individual circuits. Make terminations so there is no bare conductor at the terminal.

8. Make up splices in outlet boxes with 8-inch minimum of correctly color-coded tails left in box. Splices in wires size #8 AWG and smaller shall be made with insulated spring type wire connectors, "Scotchlok" or equivalent. Splices in larger wire and cables shall be made with indent connectors NEMA/UL approved for the purpose.

9. Use split bolt connectors for copper wire splices and taps, 6 AWG through 1 AWG. Tape un-insulated conductors and connectors with electrical tape to 150% of the insulation value of conductor. Rubber, friction and 3M-33 or 88 or better. Two (2) layers minimum each.

10. Use copper compression connectors for copper wire splices and taps, 1/0 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150% of the insulation value of the conductor. Rubber, friction and 3M-33 or 88.

11. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

12. Thoroughly tape the ends of spare conductors in boxes and cabinets.

13. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural member, and follow surface contours, where possible.

14. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to individual ground terminal of devices.

15. Parallel conductors shall be cut to the same length and be the same type of wire.

16. All splices in control panels, terminal junction boxes, low voltage control circuits and fire alarm conductors shall be on numbered terminal strip.

17. When routed in a wall, install all thermostat wire, fire alarm, computer cable, low voltage cable, and other communication cable in conduit.

18. All junction boxes shall be fully accessible.

19. All wiring shall be routed through an acceptable raceway regardless of voltage application, unless specified otherwise under other sections of these standards.
3.03 TESTING, CLEANING AND CERTIFICATION

A. Refer to Section 26 05 00 for testing, cleaning, and certification requirements.

B. Prior to energizing circuitry, check installed wires and cables with megaohm meter to determine insulation resistance levels to ensure requirements are fulfilled. Test shall be made on all feeders regardless of size and on all branch circuits with No. 4 AWG and larger conductors.

C. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

D. Subsequent to wire and cable hook-up, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.04 SCHEDULES

A. Color code secondary service, feeder, and branch circuit conductors as follows:

<table>
<thead>
<tr>
<th>120/208 Volts</th>
<th>Phase</th>
<th>277/480 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
<td>Gray</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
</tr>
<tr>
<td>Switch leg - Pink</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 &amp; 4 way travelers - Purple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Conductors shall be solid color for entire length.

C. EXCEPTION:

1. Conductors 8 AWG and larger may be black and shall be with color-coded at each termination and in each box or enclosure. For a distance of 6 inches use half-lapped 3/4 inch plastic tape in the specified color. Do not cover cable identification markings. Adjust tape locations to prevent covering of markings.

END OF SECTION
SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART I - GENERAL

1.01 DESIGN REQUIREMENTS

A. Provide equipment supports rated for the supported loads.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Conduit Hangers: Galvanized steel with special accessories for purpose and adequate to support load imposed.

B. Coatings: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance-using NEMA/UL approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

C. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, and wall brackets.

D. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.

E. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for no armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

G. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

H. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
   1. One-Hole Conduit Straps or Minerallac: For supporting 3/4 inch and smaller conduit, galvanized steel.
   2. Two-Hole Conduit Straps or Minerallac or industry approved equal: For supporting 1 inch and larger conduit, galvanized steel; 3/4 inch strap width; and 2-1/8 inch between center of screw holes.

I. Fabricated Supporting Devices:
   1. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
2. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

3. Pipe Sleeves: Provide pipe sleeves of one of the following:
   a. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint.
   b. Fabricate sleeves from the following gauge metal for sleeve diameter noted:
      1) 3-inch and Smaller: 20 gauge
      2) 4-inch to 6-inch: 16 gauge
      3) Over 6-inch: 15 gauge
   c. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
   d. EMT, IMC, or Rigid Conduit.

J. J-Hooks and Bridle Rings
   1. J-hooks and bridle rings may be used to support low voltage wiring systems.

K. The following are prohibited.
   1. Plastic or fiber anchors.
   2. Drilling or structured steel

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Conduit Hangers: Support individual conduit 1-1/2 inch and larger and all multiple conduit runs with hangers. Clamp conduits individually to each support.

B. Supports and Hangers:
   1. Support and align all raceways, cabinets, boxes, fixtures, etc., in an accepted manner and as herein specified. Support raceways on accepted types of wall brackets, specialty steel clips or hangers, ceiling trapeze hangers or malleable iron straps. Provide lead expansion shields in concrete, machine screws, bolts or welding on metal surfaces, and wood screws on wood construction. Use of powder-driven studs is prohibited without express permission from the University Project Manager.
      a. Mount all conduits to structure a minimum of 7 inches above any accessible type ceiling, or with spacing as required to permit relocation of recessed fixtures to any location.
   2. Structural and post tensioned concrete members shall not be drilled or pierced without prior approval from the University Project Manager.
   3. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging and/or straps as required to make outlet completely rigid prior to application of wall facing material.
   4. Design hangers and wall brackets so that maximum deflection will be no greater than 1/8 inch.
   5. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
   6. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer’s recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.
3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Use of ceiling support wires is unacceptable.

5. Support parallel runs of horizontal raceways together on trapeze-type hangers. Use 3/8-inch diameter or larger threaded steel rods for support. Threaded rod shall be covered by ½ inch conduit from bottom of (trapeze) support to 6-inches above cable tray.

6. Support individual horizontal raceways by separate pipe hangers.

7. Space supports for raceways in accordance with NEC.

8. In all runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

9. Threaded rod supports to have bottoms cut off at a maximum length equal to rod diameter below bottom double nut. Remove sharp edges.

D. Miscellaneous Supports: Support miscellaneous electrical components separately and as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panel boards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, support metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an engineer approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in walls and all other fire-rated floors and walls for raceways and cable installations as required. Where sleeves through floors are installed, extend above finish floor. For sleeves through fire rated-wall or floor construction, apply UL listed fire stopping sealant in gaps between sleeves and enclosed conduits and cables. See Engineering plans for location and extent of fire rated assemblies.

G. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, bus ways, cabinets, panel boards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Powder-driven studs are not acceptable. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metalscrews.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25% of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

H. Telecommunications Systems Cable Supports: Use cable tray or telecommunications approved cable supports.

END OF SECTION
SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - PRODUCTS

1.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Conduit: Allied
   a. Republic
   b. Carlon

2. Fittings and Bodies:
   a. O/Z Gedney
   b. Regal was purchased by Bridgeport
   c. Bridgeport
   d. Raco
   e. Appleton

3. Conduit Seals:
   a. Chase-Foam CTC PR-855, or approved equal

4. Wire ways:
   a. Hinged cover or screw cover complete with all necessary fittings which shall be of one manufacturer.

1.02 MATERIALS, GENERAL

A. Metal Conduit and Tubing:

1. Galvanized Steel Rigid Conduit (GRC):
   a. Conduit: Provide rigid steel conduit, hot-dipped galvanized with threaded ends. Fittings: Threaded galvanized steel, bushings shall have nylon-insulated throat.

2. Electrical Metallic Tubing (EMT):
   a. Conduit: Galvanized steel tubing, galvanized on the outside and coated on the inside with a hard smooth lacquer finish. Fittings: Steel compression fittings for rain-tight and concrete-tight applications. Steel set-screw for interior connections. Set-screw quick fit type for 2-1/2 inch and larger may be used. Bushings shall be threaded and have nylon insulated throat or nylon bushing.

3. Intermediate metal conduit (IMC)
   a. Conduit: Provide intermediate steel conduit hot-dipped galvanized Fittings: Threaded galvanized steel, bushings shall have nylon-insulated throat.

4. Rigid Aluminum Conduit:
   a. Not allowed unless otherwise noted.

5. Flexible Metal Conduit:
   a. Conduit: Continuous spiral wound, interlocked, zinc-coated steel, NEMA/UL approved for grounding.
b. Fittings: Cadmium plated, malleable iron. Straight connector shall be one-piece body, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. Angle connectors shall be two-piece body with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. All fittings 1 inch and larger shall be terminated with threaded bushings having nylon insulated throats.

c. Maximum length of 6 feet.

d. Minimum size of 1/2 inch.

6. Liquid-Tight Flexible Metal Conduit:
   a. Conduit: Continuous spiral wound, interlocked zinc-coated steel with polyvinyl chloride (PVC) jacket, NEMA/UL approved for grounding.
   b. Fittings: Cadmium plated malleable iron. Straight and angle connectors shall be the same as used with flexible metal conduit but shall be provided with a compression type steel ferrule and neoprene gasket sealing rings.

7. Non-metallic Rigid Conduit
   a. PVC plastic schedule 40

B. Conduit Bodies:
   1. General: Types, shapes and sizes, as required to suit individual applications and National Electric Code (NEC) requirements. Provide matching gasket covers secured with corrosion-resistant screws.
   2. Metallic Conduit and Tubing: Use metal conduit bodies. Use bodies with threaded hubs for threaded raceways and in hazardous locations.
   3. Telephone EL's are not acceptable.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Sheet Steel: Flat rolled, code-gage, galvanized steel.

B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

C. Fasteners for damp or wet locations: Stainless steel screws and hardware.

D. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.

E. Metal outlet, device, and small wiring boxes:
   1. General: Boxes shall be of type, shape, size, and depth to suit each location and application.
   2. Steel Boxes: Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
F. Outlet Boxes, Pull and Junction Boxes (J-Boxes):
   1. General: Boxes shall have screwed or bolted-on covers of material same as box and shall be of size and shape to suit application.
   2. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
   3. Hot dipped galvanized steel boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
   4. Outlet Boxes: Hot-dipped galvanized of required size, 4 inch square, 2” depth minimum or octagonal and of depth required for flush mounted devices and lighting fixtures. Cast-type with gasketed covers for surface-mounted devices. All outlets for exterior application shall be cast, weatherproof type with gasket and cast cover plate.
   5. Junction and Pull Boxes: Use outlet boxes as J-boxes wherever possible. Larger J-boxes pull boxes shall be accessible and shall be fabricated from sheet steel, sized according to code.

G. Non metallic boxes are not permitted.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Conduit Sizes:
   1. The conduit shall be sized in accordance with NEC.
      a. For power and lighting circuits, the minimum conduit size shall be 3/4”
      b. Flexible and Liquid-tight Flexible Conduit: 1/2 inch for all runs. Maximum 6-foot length.
      c. Conduits used for home runs shall contain only the conductors for the circuits indicated on the drawings. Combining unrelated multiple home runs into a single conduit would not be permitted.

B. Type of Conduit Used
   1. Rigid Galvanized conduit or intermediate metallic steel conduit shall be installed in the following areas.
      a. All outdoor non-conditioned locations concealed and exposed.
      b. Interior exposed. Below 10 feet to floor. PVC coated 90 degree elbows underground when penetrating floor slabs.
   2. Electrical Metallic Tubing (EMT):
      a. Interior concealed spaces.
      b. Interior exposed above 10 feet to floor.
      c. Not permitted underground, in concrete, and in hazardous or corrosive areas.
   3. Sealtite metal conduit shall be provided for: Makeup of motor, transformer or equipment, and/or raceway connections where isolation of sound and vibration transmission is required. For connections in locations exposed to weather, or in interior locations subject to moisture, watertight flexible conduit shall be used.
   4. Non-metallic Rigid Conduit:
      a. In concrete and underground.
b. Not permitted for interior use.

C. General: Install electrical raceway in accordance with manufacturer’s written installation instructions, applicable requirements of NEC, and as follows:

1. Conceal all conduits unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes.

2. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping, keep close to structure.

3. Complete installation of electrical raceways before starting installation of conductors within raceways.

4. Provide supports for raceways as required per NEC. Prevent foreign matter from entering raceways by using temporary closure protection.

5. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel. All bends shall be made in an approved bending machine or factory-made. Hickey bends will not be permitted in conduits larger than 3/4 inch. Refer to Section 27 05 28 for special bending requirements for Telecommunications Systems.

6. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. Install expansion fittings across all structural construction joints and expansion/deflection couplings across all structural expansion joints and in every 200 feet of linear conduit run. A flexible bonding jumper at least three times the nominal width of the joint shall be installed.

7. Run concealed raceways parallel and perpendicular to building elements at right angles.

8. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Paint all exposed raceways to match surrounding area.

9. Run exposed and parallel raceways together. Make bends in parallel runs from the same centerline so that the bends are parallel. Factory elbows may be used only where they can be installed parallel. In other cases, provide field bends for parallel raceways.

10. Make raceway joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Joints in non-metallic conduits shall be made with solvent cement in strict accordance with manufacturer’s recommendations.

11. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. RGC shall be secured with double locknuts and an insulated metallic bushing. EMT shall be secured with one locknut and shall have nylon-insulated throats or threaded nylon bushings from 1/2 inch to 1 inch. 1-1/4 inch and above shall be metal with nylon insulated throats. Use grounding type bushings for feeder conduits at switchboards, panel boards, pull boxes, transformers, motor control centers, VFDs, etc.
12. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

13. Install pull wires in empty raceways. Use #14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end.

14. Telecommunications and Signal Systems Raceways: Refer to Section 27 05 28 Pathways for Communications.

15. Install raceway-sealing fittings in accordance with the manufacturer’s written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL Listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway-sealing fittings at the following points and elsewhere as indicated:
   a. Where conduits enter or leave hazardous locations.
   b. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
   c. Where required by the NEC.

16. Flexible Connections: Use short length (maximum of 6 feet) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet locations. Install separate ground conductor in all flexible connections.

17. Conduit Seals: Conduit passing through concrete walls shall be sealed.

18. Where conduits are to be installed through structural framing members, the contractor shall provide sleeves. Cut all openings in concrete with rotary type drill, or other method as approved by the University Project Manager. Holes cut with pneumatic hammer will not be accepted. For areas where sleeves have not been provided, the Engineer’s written approval must be obtained prior to cutting, notching or drilling of structural framing members.

19. Ream the ends of all cut and/or threaded conduit. Ends shall be cutsquare.

20. Use of running threads for rigid metallic conduit are not permitted. When threaded couplings cannot be used, provide 3-piece union or solid coupling.

21. Conduits shall not cross pipe shafts or ventilation duct openings “access panel”.

22. Conduit shall not obstruct full and direct access to equipment requiring maintenance. This includes but is not limited to valves, actuators and terminal box controllers.

23. Install an insulated ground conductor in all conduits.

24. Where individual conduits penetrate fire-rated walls and floors, provide pipe sleeve one size larger than conduit; pack void around conduit with fire rated insulation and seal opening around conduit with UL Listed foam silicone elastomer compound. Conduits on trapeze type support system shall require fire taping only.

25. Where conduit sleeves penetrate fire rated floors or walls for installation of system cables, AC or MC cables, or modular wiring cables, pack void around cables or empty sleeve with fire rated insulation and fill ends with fire-resistive compound. Seal opening around sleeve with UL Listed foam silicone elastomer compound.

26. Provide separate raceway systems for each of the following:
   a. Lighting
b. Power Distribution

c. Emergency (Essential)
   1) Lighting
   2) Power distribution

d. Low voltage systems, including telephone and communications, EQ alarm, security, fire alarm.

e. Audio/Visual

27. Provide for waterproofing of all raceways, fittings, etc., which penetrate the roof to preserve the weatherproof integrity of the building. Installation of materials shall conform to the following:
   a. General:
      1) Install all raceways concealed except at surface cabinets, for motor and equipment connections and in mechanical equipment rooms. Install a minimum of 6 inch from flues, steam pipes or other heated pockets for water-flashing and counter-flashing or pitch pockets for waterproofing of all raceways, outlets, fittings, etc., which penetrate roof. Route exposed raceways parallel or perpendicular to building lines with right angle turns and symmetrical bends. Concealed raceways shall be run in a direct line, and where possible, with long sweep bends and offsets.
      2) Provide raceway expansion joints with necessary bonding conductor at building expansion joints and where required to compensate for raceway or building thermal expansion and contraction. Terminate raceways 1-1/4 inch and larger with insulated bushing or rain tight connections with insulated throats.

28. Special areas methods for raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.), in all special occupancy areas, as defined and classified in Article 500 of the National Electric Code (NEC), shall be in accordance with that Article.

29. If type MC or AC cable is used for branch circuits, the home run conduit will be EMT and must run from the panel to within 10 feet horizontally of the first device served.

30. All underground raceways, not under the building footprint, shall be installed so it slopes away from the building.

D. Raceway Installation:
   1. Surface raceways, where indicated on drawings, shall be metal and of a size approved for number and size of wires to be installed, shall be installed in a neat, workmanlike manner, with runs parallel or perpendicular to walls and partitions. Raceways, elbows, fittings, outlets and devices shall be of same manufacturer, and designed for use together.
   2. Wire ways, where indicated, complete with elbows, tees, connectors, adaptors, etc., with all parts factory-fabricated and of same manufacture.

3.02 INSTALLATION, GENERAL

A. Boxes:
   1. Every J-box shall be secured, independent of conduit entries into the box. Boxes shall be secured to the building structure. Ceiling wire shall not be used to support (secure) J-boxes.
   2. Box fill shall be governed by code requirements. Only the allowable amount of conduit entries shall be allowed into the box.
3. Box covers shall be marked so as to indicate the voltage, panel number, and circuit number of the enclosed conductors.
4. Each J-box shall have only one voltage installed.
5. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
6. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
7. Remove sharp edges where they may come in contact with wiring or personnel.
8. All conduits connected to a flush panel shall be concealed.

B. Outlet Boxes

Campus Guidelines and Design Standards

1. Exact location of outlets and equipment shall be governed by structural conditions and obstructions or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment. Verify final location of all outlets, panels, equipment, etc. with the University Project Manager.
2. Switch Outlet and Panel board height dimensions to meet ADA requirements.
3. Above counters, benches, special equipment, baseboards, fin tube radiators, etc., or at wainscoting, outlets shall be mounted minimum 6 inches above to prevent interferences to service equipment, or as noted on drawings.
4. Fire rated poke-through shall be installed in areas to miss beams and ductwork in ceiling below. Floors shall be X-rayed before core drilling.
5. Outlets at windows and doors: Locate close to window trim in an accessible location. For outlets indicated above doors center outlets above the door opening except as otherwise indicated.
6. Column and pilaster locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions. Locate in an accessible location.
7. Locations in special finish materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.
8. Mounting: Mount outlet boxes for switches and receptacles with the long axis vertical or as indicated. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the strike side, close to door trim. Provide far side box supports for electrical boxes installed on metal studs.
9. Ceiling outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by l-1/2 inches deep, minimum.
10. Protect outlet boxes to prevent entrance of plaster, and/or debris. Thoroughly clean foreign material from boxes before conductors are installed.
11. Concrete boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.
12. Existing outlet boxes: Where extension rings are required to be installed, drill new mounting holes on the existing boxes where existing holes are not aligned.
13. Back to back outlet boxes are not permitted. Separate boxes a minimum of 6 inches in standard walls and 24 inches in acoustical walls.

C. Installation of Pull and J-Boxes:
1. Box selection: For boxes in main feeder conduit runs, use minimum 8-inches square by 4-inches deep or as needed per NEC. Do not exceed 6 entering and 6 leaving raceways in a single box.
2. Cable supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
3. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.
4. Every J-box shall be secured, independent of conduit entries into the box. Boxes shall be secured to the building structure. Provide rigid supports for all J-boxes, ceiling wire supports are not acceptable.
5. Box fill shall be governed by code requirements. Only the allowable amount of conduit entries shall be allowed into the box.
6. Box covers shall be marked so as to indicate the voltage, panel numbers, and circuit number of the enclosed conductors. Use pre-printed labels, marking cover with permanent marker is not acceptable.

D. Grounding:
1. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

E. Outlets:
Campus Guidelines and Design Standards
1. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inch octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8-inch no-bolt fixture studs. Where fixtures are mounted on or in an accessible type ceiling, provide a J-box and extend flexible conduit, maximum 6’ to each fixture. Outlet boxes in finished ceilings or walls shall be fitted with appropriate covers, set to come flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide tile box or a 4-inch square box with tile ring where "drywall" type materials are applied.

F. Pull and J-Boxes and Cabinets:
1. Construct J-boxes or pull boxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "Cabinets," with hinged covers of same gauge metal. Removable covers must be accessible at all times.
2. Provide a standard access panel having a hinged metal door neatly fitted into a flush metal trim, where a J-box or equipment is located above non-accessible ceilings or behind finished walls. Coordinate location and type with the University Project Manager. Access panels shall be minimum 24”x24” or 6” larger than pull box.
3. All cabinets shall be set rigidly in place with fronts straight and plumb, center panel board interiors in door openings.

END OF SECTION
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. All electrical equipment and systems shall be properly labeled in accordance with this section. It includes requirements for electrical identification components including but not limited to the following:
   1. Identification labeling for raceways, cables, and conductors.
   2. Equipment labels and signs.

1.02 SUBMITTALS

1. Samples of each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Ideal Industries, Inc.
   2. LEM Products, Inc.
   3. Markal Corp.
   4. Panduit Corp.
   5. W.H. Brady, Co.

2.02 MATERIALS, GENERAL

A. Nameplates: Engraved plastic laminate, black letters on white background for normal systems and white letters on red background for emergency systems.

B. Electronic Labels: 9mm self-adhesive tape, black letters on clear for normal systems and red letters on clear for emergency systems. Embossed DymoType labels are not accepted.

C. Wires and Cable Markers: Cloth markers, split sleeve and tubing type.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. Degrease and clean surfaces to receive nameplates and labels.

C. Conduit Identification: Use adhesive marking labels at 40 foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Use the following colors:
   1. 600 Volt and Below: Black letters on orange background indicating feeder identification and
   2. Other Systems: Provide color banding as specified below.
D. Identify System Raceways with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Provide Brady B-946 vinyl or equivalent. Colored duct tape is not acceptable. Apply the following colors:
   1. Security System: Blue and Yellow with Gray Cable.
   2. Telecommunications System: Green and Yellow with Blue and White Cables.
   6. Lighting Control Cabling shall be Green.

E. Identify Junction, Pull, and Connection Boxes: Identification of systems and circuits shall be pressure-sensitive, self-adhesive label indicating system voltage and identity of contained circuits on outside of box cover. Color code shall be same as conduits for pressure sensitive labels. Use pressure-sensitive plastic labels at exposed locations and indelible marker (black or red) at concealed boxes. All fire alarm boxes shall have covers painted red.

F. Power Circuit Identification: Tag or label conductors as follows:
   1. Multiple Circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure label each conductor or cable including neutrals. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
   2. Match identification markings with designations used in panel boards shop drawings, Contract Documents, and similar previously established identification schemes for the facility’s electrical installations.

G. Install equipment/system circuit/device identification as follows:
   1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless the unit is specified with its own self-explanatory identification. Text shall match terminology and numbering of the Contract Documents and shop drawings. Identification must include equipment name, voltage, phase, amperage, and fed from. Apply labels for each unit of the following categories of electrical equipment.
      a. Switchboards, switchgear, panelboards and enclosures, 1/2” high lettering.
      b. Access doors and panels for concealed electrical items, 1/4” letters
      c. Transformers 1/2” high letters.

H. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panel boards and alarm/signal components, where labeling is specified elsewhere.

I. For panel boards, provide framed, typed circuit schedules (label all spares and spaces in pencil) with explicit description and identification of items controlled by each individual breaker.

IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 53- 2
J. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

K. Provide tape labels for identification of individual receptacle and switch wall plates. Locate tape on front of plate and identify branch circuit serving the receptacle or switch.

END OF SECTION
PART I - GENERAL

1.01 DESIGN REQUIREMENTS

A. Plug-in type devices are not acceptable.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide wiring devices of one of the following:
   1. Devices:
      a. Harvey Hubbell Inc.
      b. Leviton Mfg. Co.
      c. Pass and Seymour Inc.
      d. Bryant Electric Co.
      e. General Electric Co.
   2. Wall (Local) Switches: Numbers used below are those of Hubbell. Equivalent Cooper, P & S, or Leviton.
   3. Fire Rated Poke-through Receptacle: Hubbell systems or approved equal.
   4. Multi-Outlet Assembly (MOA): Hubbell or Wiremold.

2.02 MATERIALS, GENERAL

A. Receptacles:
   1. Duplex receptacles shall be of the heavy-duty type, NEMA 5-20R configurations. They shall be capable of being side or back wired, with clamp type terminals for back wiring. The grounding blades shall be aligned in such a manner that they are parallel to the longitudinal plane of the receptacle. Plus type receptacles are not permitted.
   2. All duplex, single, and special receptacles shall be heavy duty, standard grade listed by Underwriter’s Laboratories, and have a single brass mounting strap with self-grounding and have a hex-head green grounding screw and be side and back wired. Each device shall bear the UL/FS Label.
   3. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20R.. All receptacles connected to emergency circuits shall have a red face. Color selection for normal devices shall be verified with Engineer prior to ordering.
   4. Standby Receptacles: Single or duplex minimum 20-amp, color red.
   5. Isolated Ground Circuit: Single or duplex minimum 20-amp, color orange, with isolated ground.
   7. Telephone or CRT Receptacles: 4 inch square box with one gang plaster ring and 5/8 inch diameter grommet hole split plate.
   8. Special Purpose Receptacles: Provide where shown on drawings. Standard grade, standard color, and of the appropriate code and NEMA configuration to match the supply circuit and load involved. Provide proper grounding through receptacle for equipment.
   9. Fire Rated Poke-through: Provide where shown on drawings. Poke-through shall provide services as shown on drawings and have a carpet saver feature.
### B. Switches:

1. **Wall Switches for Lighting Circuits:** NEMA WDI; FS W-S-896E; AC, quiet type, specification grade, listed by Underwriter’s Laboratories with toggle handle, rated 20 amperes or greater at 277 volts AC, unless noted otherwise. Mounting straps shall be metal and be equipped with a green hex-head ground screw. Each switch shall bear the UL/FSLabel.

2. **Handle:** Red for emergency power circuits. Verify color for normal power devices with Engineer prior to ordering.

3. **Pilot Light Type:** Lighted handle lit when switch is "on."

4. **Locator Type:** Continuously lighted handle.

<table>
<thead>
<tr>
<th>Switch Type</th>
<th>Code</th>
<th>Amps</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Pole</td>
<td>#1221</td>
<td>20</td>
<td>277</td>
</tr>
<tr>
<td>Three-Way</td>
<td>#1223</td>
<td>20</td>
<td>277</td>
</tr>
<tr>
<td>Four-Way</td>
<td>#1224</td>
<td>20</td>
<td>277</td>
</tr>
</tbody>
</table>

### C. Wiring Device Accessories:

1. **Wall Plates:** Provide Wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates. Identify all wall plates used for receptacles with branch circuit number. Provide blank wall plates for all cable, data, telephone and junction and outlet boxes. Where cables are routed through the wall plate, provide grommets in wall plate openings to protect cables. Provide plates possessing the following additional construction features:

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

A. Verify boxes are installed at proper height and openings are neatly cut and will be completely covered by wall plates.

B. Verify branch circuiting wiring installation is completed, tested, and ready for connection to wiring devices.
3.02 INSTALLATION, GENERAL

A. Install wiring devices of type as indicated on drawings. All connections shall be made up tight and device set plumb. Use care in installing device in order to prevent damage to device and wire in outlet box. Install wiring devices as indicated, in accordance with manufacturer’s written instruction, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

C. Install wiring devices only in electrical boxes that are clean; free from excess building materials, dirt, and debris.

D. Install wiring devices after wiring work has been installed and wall finishes have been completed. Install wall plates plumb and level, after painting work is completed. Provide a device plate for each outlet to suit device installed and install blank plates or covers for J-boxes and empty outlets.

E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values for wiring devices or as required per UL Standards 486A.

F. Upon installation of wall plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Final Completion, replace those items that have been damaged, including those burned and scored by faulty plugs.

G. Provide equipment grounding connections for wiring devices, unless otherwise indicated.

3.03 TESTING, CLEANING, AND CERTIFICATION

A. Refer to Standard Section 26 05 00 for testing, cleaning, and certification requirements.

B. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

C. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION